FLIGHT
and
The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor C. M. POULSEN

Managing Editor G. GEOFFREY SMITH

Chief Photographer JOHN YOXALL

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The Outlook

German Air Scouts

THE German reconnaissance aircraft have now turned their attention from the Shetlands to the mainland of Great Britain. Manchester and the Merseyside district first received attention from a lone Heinkel, flying at a great height. Next, another machine crossed the Sussex coast and reached the outskirts of London on Monday morning, while another one visited several points on the coast of Kent. The same evening, after dark, warnings were sounded in East Kent when yet one more German aircraft approached the coast without penetrating inland. None of these machines made determined attempts to defy the defences, and all retreated hurriedly when fired at by anti-aircraft guns. Fighters went up near Manchester and London, but the intruders had made good their escape before contact could be made.

There can be no doubt that these machines were engaged only on reconnaissance and, where possible, photography. It is never the duty of a scout to fight, but always to get home with the news which it has collected. For that reason it is not in the least surprising that our fighters were unable to intercept. The German scouts in each case made good their escape long before the fighters could climb up to their height. The public must not argue from the prompt escape of these scouts that bombers will be equally immune. Bombers have a different sort of duty; they must try to reach their objectives, and must not sheer off home at the first suspicion of danger. They must face their risks, and in the case of attacks on Great Britain they will certainly have to pay the penalty of temerity.

Sincere Flattery

THESE scouting trips over Britain have been accompanied by similar flights over France, and it is rather amusing to note that in some of the latter cases leaflets have been dropped. Presumably the German propaganda department, with its notorious ignorance of any mentality except its own, still hopes to awaken an anti-British sentiment among the French people, and so divide the Allies. It seems impossible for the Germans to understand the feelings of resolution and honour which are essential parts of the French make-up. Nor are they able to realise that the French, with their bitter memories of two invasions and of fair provinces laid waste, have inherited a natural antipathy to the aggressive spirit which Germany manifests in generation after generation. We British are not a whit less resolute to end the reign of German terror in Europe, but we have not experienced the occupation of our land by German invaders. German propaganda would be useless in either of the Allied lands, but the Germans, as one would expect, have first tried it on the least promising subject.

So now, in the third month of the war, we find the Germans starting reconnaissance flights and the dropping of leaflets in somewhat the same manner in which we have been doing these things since the beginning of September. This imitation is no doubt flattering, but we may well wonder why a beginning was not made earlier. For weeks our machines have been flying over Germany by day and by night, and have amassed a great amount of information about present circumstances there. It will take the German Intelligence people a long time to catch up our start.

No Comparison

APART from the late start made by the Germans, there is no comparison between their efforts to collect information and ours. We have said above that the chief duty of a scout is to get home with his information. It is also his duty to inform himself as fully as possible before turning for home. We have lost count of the number of times which our aircraft have flown over Germany, but we do know that our crews

BRIM FULL : The risk of a German invasion of Holland, apparently imminent a short time ago, seems to have receded. But the Dutch are not only keeping their powder dry, they are also keeping their rivers full, ready for flooding, as this air view shows.

have not turned back at the first hint of danger. They have been repeatedly fired at intensively by anti-aircraft guns, and often too they have been attacked by German fighters. We have lost a few of these scouting machines, three or four in all, which is a small price to pay for the great mass of information which our Intelligence Department has now acquired. On page 415 of this issue some of the stories are told of how our scouts have beaten off attacks by German fighters, or have eluded them and got away safely.

When one considers this, it is rather astonishing. There seems no doubt that our airmen have learnt a sort of contempt for the Messerschmitt, though it is within the knowledge of *Flight* that it is a very fine aeroplane. From this one is inclined to infer that it is usually not well handled by the German pilots. There is no doubt at all that the standard of training and the experience (expressed by number of hours spent in the air) is far lower in the *Luftwaffe* than it is in the Royal Air Force. But perhaps some Boelcke will arise and put new spirit into the German fighters.

On the other hand, it is certain that the German airmen have learnt a great respect for British eight-gun fighters and the expert pilots who fly them. So far there has been no pitched battle between British and German fighters, but the French pilots in their Curtiss machines have shown that the Messerschmitt, even in superior numbers, is no almighty ruler of the skies. Yet even so the scouts do not always escape. On Tuesday one of them was not quick enough in sheering off from our East Coast. Our fighters caught it. Their speed and fire power make our fighters terrible opponents.

It may be that the recent German addiction to reconnaissance over Britain and France portends the much-vaunted air attacks which we once thought would be the first action of the war. If so, the deductions to be drawn from encounters up to date justify us in awaiting them with calm confidence as to the result.

FLIGHT and The AIRCRAFT ENGINEER

THE BRITISH AIRCRAFT INDUSTRY

TWO special issues of *Flight* containing the annual review of the British Aircraft Industry will be published on the following dates and bearing the titles indicated.

NOVEMBER 30 .. .. MILITARY AND CIVIL AIRCRAFT
DECEMBER 7 .. .. .. ENGINES, COMPONENTS AND MATERIALS

Orders for these annual special numbers should be placed early; Sixpence as usual.

WAR in the AIR

Eyewitness Impressions of the R.A.F. in the Field—Part 2.

By H. F. KING

ONE afternoon in March, 1936, the Fairey Aviation Company invited the Press to their Heath Row aerodrome to watch "Chris" Staniland demonstrate something new in military aircraft. It was an elegant bomber monoplane with a single Rolls-Royce Merlin engine and was described by the lay Press as a "battle-bomber."

Since that sunny afternoon at Hayes many clouds have crossed the sky. The Fairey Battle is no longer a silver form disporting itself over Middlesex, but a drab, shapeless part of the soil of France.

That, at least, was the impression I received when I saw my first Battle squadron on active service.

The machines are disposed round the borders of the aerodrome. They hide among the trees or crouch under camouflage nets. Now and again they fly over the lines and come back with photographs of Germany. A few have not returned. Sometimes they practise formation flying as they did over the fields of Wiltshire. Or they may fly out to a French bombing range and drop live bombs on the target with impressive precision; or cruise along in formation at 200-odd miles an hour with French Curtisses playing war games behind their tails.

Standing By

They are finding plenty to do until such time as they may be called upon to fill their bomb-racks and demonstrate to the *Luftwaffe* that the Ju 87 is not the only single-engined bomber in the world.

While I was in France I was taken to visit a Battle squadron which must be typical of any unit operating aircraft of this type on active service.

The conducting officer piloted us through the mud of a village to a very unimposing-looking house. The interior was architecturally just as unimaginative, but the sharp tapping of a typewriter, the economy of a voice on the telephone and the familiar inscriptions on the doors instantly stamped it "R.A.F. Sqn. H.Q."

The arrival of the C.O. was the signal for a barrage of questions, which were answered willingly, though often in consultation with our conducting officer. The C.O. seemed more inclined to talk of the diplomacy and the knowledge of building required for billeting rather than of the technique of strategical reconnaissance, but he did say that his Battles had been over the lines on a number of occasions and had made their reconnaissance apparently unnoticed and quite unhindered. He emphasised that any bomber squadron might be required to undertake reconnaissance work.

Billeting

Indicative of the concern he has for the comfort of his men he first of all conducted us round typical billets. These were as good as a small French village could offer. Some were in houses, others in barns or sheds. The men try to out-do each other in the intimacy of their furnishings and decorations and there is much ingenious improvisation.

The Sergeant's Mess was particularly attractive, the walls being decked with refreshing photographic studies from the more relaxing of English and French illustrated publications. The sergeants sat in wicker chairs round their fires. Behind them was a very efficient-looking bar.

Outside we watched the men forming up, plate in hand, for their lunch at the field kitchen, in which petrol-gas burners heated a first-class stew, with sultana roll to follow. The milling of many feet had created a mire, and "grills," such as are used on aerodromes for cover-

"Flight," photograph.

Its good take-off and landing qualities enable the Battle to operate from aerodromes of comparatively small dimensions. It will be seen above how the fine lines of the machine are broken up when the wheels and flaps are lowered.

ing bomb craters and making runways, had been put to good effect.

Sensing our favourable reaction to the stew, the C.O. took us on to the Officers' Mess, which was in the classical *Dawn Patrol* tradition.

The Mess is on the second storey of the village café. It was immediately apparent that loving care had been lavished not only on the decorations and furnishings of the room, but on the stocking of the bar, to which there was a marked gravitation on our entry.

The walls were bright with murals, executed by a French transport driver, depicting Curtisses and Messerschmitts in dramatic mêlées. It was apparent that the T.D. was primarily an artist; at least, he had drawn some German machines the technical conception of which would never have been countenanced by Generalmajor Udet in his most imaginative mood.

After lunch we went out to look at the squadron hospital, complete with operating table. The M.O. said that the water was quite pure and seemed generally satisfied with his side of things.

The mumble of Merlins from the aerodrome told of the departure of a flight of Battles for some formation work. They were to have gone through the motions of a dive-bombing attack on the aerodrome, but the C.O. had decided that conditions were unsuitable.

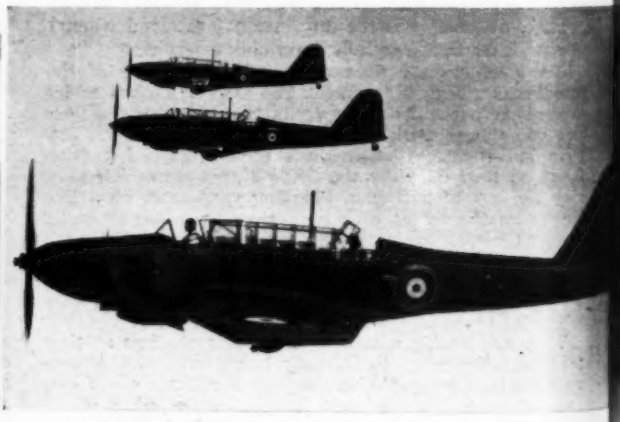
A few minutes walk brought us to the aerodrome where the machines were tucked away behind haystacks or screened by trees. And so they stay in all weathers, kept airworthy in spite of mud, rain, cold and dark.

Invisibility

I recalled that on my way to Base Headquarters in a D.H.86 I had seen "parked" Battles from the air. But only just, and then from a very low altitude.

In the guard "room" the off-duty sentries drowsed contentedly while some rich Cockney floated across from one of the Battles. But things are not always thus. A flight of French Curtiss or Morane fighters sometimes flies over from a neighbouring aerodrome and does a courtesy "beat-up" which is returned at some future date. Despite their sub-

Gaumont British News



In France the Battles are camouflaged while on the ground by special nets or are screened by trees or haystacks. The view on the left shows a typical scheme. On the right is a flight of Battles at formation practice.

WAR IN THE AIR (Eyewitness Impressions Continued)

stantial size and weight Battles are generally credited with one of the most dramatic of these courtesy calls to date. This is no place to chronicle the details of what was, after all, a social gesture, but one recalls that the story associated wing-tips and grass.

Beside the aerodrome is one of those efficient field-service offices on wheels. These appear to be more comfortable and convenient than some of the "H.Q." offices which have been established in private houses. The squadron I visited had no photographic dark-room of its own, but complete facilities were available at "Wing" which was not far distant.

One day after my visit to the Battle's aerodrome I was invited to watch some live-bombing practice with aircraft of this type.

It was a bitterly cold, grey afternoon and we grouped in the gravely mud round the observation pill-box sipping scalding tea and listening to the B.B.C.'s broadcast of one of Charles Gardner's stories which we had discussed with him the night before at ——.

The first Battle came over low and I saw a bomb leave the carrier. Apparently the bomb was of the delayed-action type for nothing happened for some seconds when there was a smoky upheaval. Appreciably later I heard the bang and felt the concussion.

Subsequent drops appeared to be uniformly accurate though I judged that the machines were not going flat-out as they would be during an actual bombing attack. Perhaps the pilots were nursing their engines.

As the Battles completed their practice they headed back and we watched them descend to their aerodrome.

The sunset, as we drove back over that pitiful, wasted and, by this time, ghostly ridge, seemed as wet and red as blood. A great black storm cloud rolled up from Germany.

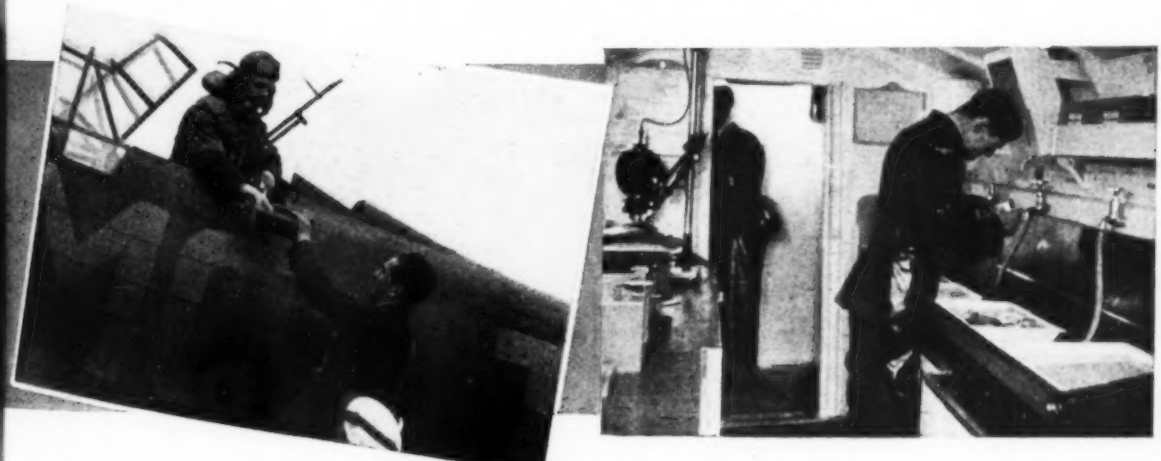
But back at H.Q. someone said "cinq coupes" and it was all forgotten.

In France the Battle squadrons are dropping live bombs on the ranges. A flight of these machines is seen above "attacking" with ordinary practice bombs.

NEWS OF THE WEEK

IN our last issue allusion was made on our Outlook page to the German raid on the Shetlands. Sir John Simon, deputising for the Prime Minister, who was still laid up with gout, read the weekly progress report on the war in the House of Commons on Thursday, Nov. 16, and alluded to the Shetland raid in these terms:

"As members of the House already know, four enemy aeroplanes dropped bombs in the Shetlands on Nov. 13. They were heavily engaged by our anti-aircraft forces, and the bombs, twelve of which fell on land and eight in the sea, caused no casualties and negligible damage. Elsewhere there has been considerable activity in the air, although it has been of a desultory character, and there have been no major engagements. Nevertheless, as hon. members will be aware from the particulars which have been published, a number of successes have been won



A Battle has no sooner rolled to a standstill after a reconnaissance flight over the lines than the photographic plates are passed down to waiting hands. On the right is a typical scene in one of the R.A.F.'s mobile developing rooms.

WAR IN THE AIR (CONTINUED)

Reproduced from the British Movietonews Film.

A short-nosed Heinkel bomber which was brought down by two British fighters near Hazebrouck after each had fired one burst. The pilot was killed before the machine reached the ground; one member of the crew had a bullet in the back and the other two escaped uninjured.

which have given us further vivid illustrations of the dash and gallantry of the Royal Air Force."

The German High Command, dealing with the raid, said: "Despite unfavourable weather conditions, a German squadron undertook a raid over the Shetland Islands. Two seaplanes were destroyed. An apparent hit on a British cruiser could not be observed with certainty. All our 'planes returned intact."

To this the Admiralty and the Air Ministry replied: "Reports from Berlin describing the air attack on the Shetlands on Monday, November 13, announced the destruction of two flying boats by German aircraft. These reports are untrue—no ship or flying boat was damaged."

The *London Gazette* announces the following rewards for gallantry:

Medal of the Order of British India (Military Division).

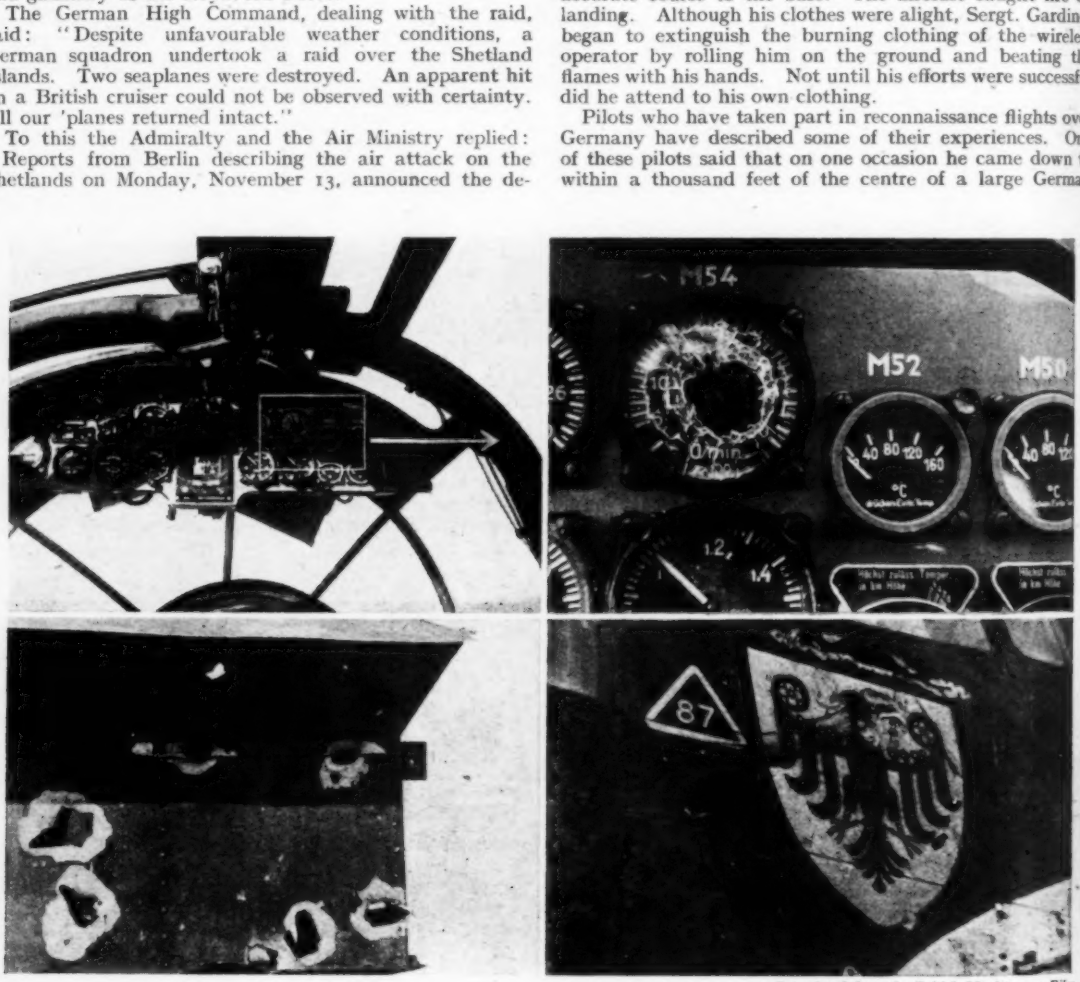
Graveley, Flying Officer R. C., R.A.F.

This officer displayed great gallantry and a total disregard of his own safety when the aircraft of which he was the pilot was shot down by an enemy fighter in September and crashed in flames. Though badly burned, he pulled his wounded air observer from the wreckage to a place of safety and returned to rescue the air gunner. He found the airman dead, however, and was unable to lift him from the cockpit.

Gardiner, Sergt. F. H., R.A.F.

In September the aircraft in which Sergt. Gardiner was air observer was seriously damaged by enemy aircraft. Two petrol tanks were punctured, but, despite the fumes and much bleeding from a slight gunshot wound over the right eye, the airman succeeded in setting an accurate course to the base. The aircraft caught fire on landing. Although his clothes were alight, Sergt. Gardiner began to extinguish the burning clothing of the wireless operator by rolling him on the ground and beating the flames with his hands. Not until his efforts were successful did he attend to his own clothing.

Pilots who have taken part in reconnaissance flights over Germany have described some of their experiences. One of these pilots said that on one occasion he came down to within a thousand feet of the centre of a large German



Reproduced from the British Movietonews Film.

Some details of the Heinkel seen above. The top left-hand view shows the pilot's instrument panel and the generous amount of "transparency" provided in the nose. The section outlined is shown enlarged in the top right-hand picture. The rev. counter has been struck by a bullet and stopped at 1,800 r.p.m. Below is a piece of the structure bearing the marks of the battle, and finally, *Der Adler* minus a few feathers. It will be noted that the machines are operating on 87-octane fuel.

WAR IN THE AIR (CONTINUED)

town, but was apparently not noticed, as no action was taken against him. On another day, however, he came down to four thousand feet to inspect a German city and found himself in the centre of what he called "bucketfuls of projectiles." He dived straight away for another thousand feet and so escaped.

Our reconnaissance machines have had experiences with German defensive fighters. On one occasion three fighters were seen at a distance, but did not attack our aircraft. On another occasion an aircraft dodged two German fighters among the clouds. One pilot was attacked by single fighters on two separate occasions. The first of these enemy machines turned off after our gunner had let off a couple of bursts of fire at 200 yards. The second came to close quarters, but was beaten off, and our gunner felt pretty sure that he had hit it. On another occasion one of our machines drove off three enemy fighters which had come up to about 200 yards distance.

A very satisfactory point about these reconnaissance flights has been the accuracy of the navigation. The first British machine to reach Berlin flew there through clouds, and when he reckoned he was above the German capital the pilot came down lower to check his position and found that his calculations had been quite accurate. Searchlights picked him up, but otherwise he was undisturbed.

More than 100 photographs showing enemy military objectives in considerable detail and containing information of vital importance have been brought back from a single reconnaissance carried out under favourable weather conditions. In one recent raid, 16 enemy aerodromes were photographed, in addition to the well-defended towns of Emden and Hamburg.

The total distance flown on each of these raids has seldom been less than 800 miles, of which nearly half has been over the North Sea and the remainder over German territory. Of the total number of aircraft employed on these occasions all but a few have returned safely. Such dangerous work as these long-distance reconnaissances, exposed as they are to enemy attack and the natural hazards of winter flying, has necessarily involved occasional losses.

Many acts of gallantry have been performed by members of crews. In the course of one flight, carried out for the greater part of the distance at an altitude where the temperature was 20 degrees below zero, an aircraft was hit by A.A. fire while returning from its objective and the air gunner was wounded. To reach him, it was necessary to squeeze through a narrow opening inside the fuselage. The N.C.O. observer found that he was only able to do so by discarding his parachute harness, life-saving jacket and warm outer clothing. Having done this, and having worked his way through the opening, he found his companion badly wounded in the hand and thigh. He dressed the hand wound with a first-aid kit, but decided to leave the more serious thigh wound untouched, realising that the loosening of the wounded man's clothing would probably result in dangerous loss of blood. Warming him with his body and encouraging him with reports of their progress, the observer remained with the wounded man till they were clear of Germany. He then returned to the front cockpit and attended to his navigational duties till his base was in sight, when he again made his way back to the wounded air gunner and stayed with him till they landed. Throughout the whole of the return flight from Germany the observer was without his flying clothing, in a temperature never above freezing point.

On Monday, November 13, a German raider appeared off the East Coast. It was a cloudy day and this handicapped our fighter pilots who tried to engage the enemy. One of them got in a burst at comparatively short range. The British pilots thought that they saw a piece of the enemy's port wing shot away before he disappeared into the clouds.

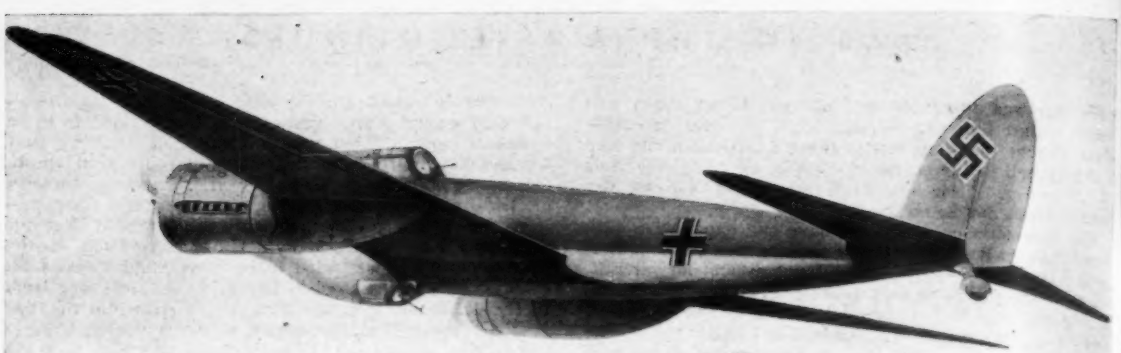
There was yet another incident over the sea on the same day when a reconnaissance machine of the Coastal Command attacked an enemy submarine. The German craft was seen on the surface, but it began to submerge quickly as soon as the attack developed. The G.R. machine dropped a salvo of bombs which fell some on each side of the submarine. One bomb appeared to the pilot to make a direct hit when the submarine had reached periscope depth. This impression was confirmed by the air gunner. The sea was very rough at the time and the broken water made accurate observation impossible.

An enterprising German machine carried out a reconnaissance over South Lancashire and surrounding parts on Friday, Nov. 17, soon after 11 a.m. It was believed to be a Heinkel. It was detected by the R.A.F. Observer Corps, and raid warnings were sounded. The official communiqué said that "Anti-aircraft guns were in action near Manchester and at Merseyside, where British fighters went up and drove away the enemy aircraft. No bombs were dropped."

In a recent issue we reported a gift of £100,000 by His Exalted Highness the Nizam of Hyderabad towards the cost of a new fighter squadron. It is now announced that this squadron will be known as "The Hyderabad Squadron" and it is proposed that it should adopt as its badge a crescent based on the crest of His Exalted Highness and a motto associated with the Nizam and his State, for which the title "Faithful Allie" is suggested. His Exalted Highness has agreed with this suggestion and expressed his appreciation of the proposal.

One of the Messerschmitt Me 109 single-seater fighters which was brought down in French territory after an engagement with French Curtisses. On this occasion nine Frenchmen are said to have attacked twenty-seven Germans and to have brought down nine. Reports vary considerably.

A French Curtiss single-seater fighter of the squadron which is said to have engaged twenty-seven Messerschmitts. The engine is a Pratt and Whitney Twin Wasp. It will be noticed that the wing guns are covered. The machine shown has four Brownings but later versions have six.



So far as can be gathered from a small Leica transparency showing the machine at a distance, the Junkers Ju 88 bomber looks essentially like this *Flight* "reconstruction."

A SECRET WEAPON

More Details of the Junkers Ju 88 Bomber

OF all the machines in service in, or being delivered to, the German Air Force the greatest secrecy attaches to the Junkers Ju 88 high-speed twin-engined bomber.

Up to the present *Flight* is the only publication to have attempted to describe and illustrate this machine in any detail. In the issue of October 12 this year it was referred to in the following terms:

"In appearance the Ju 88 is striking as the nacelles hang beneath the low cantilever wing, reminding one of the De Havilland Comet. It is quite a small machine and carries a crew of three. The fuselage is of good aerodynamic form and approximately of oval section though the bottom is flat in the region of the bomb bay. The cockpit enclosure, which opens transversely, is over the leading edge of the wing and the nose of the fuselage tapers sharply and is provided with the usual transparent panels. Cantilever tail surfaces are used and there is a single fin and rudder.

"In plan form the wing has been evolved from that of the Ju 86, having a swept-back leading edge. The entire trailing edge is hinged, the inner sections acting as flaps and the outer ones as ailerons.

"Perhaps the most interesting feature of the machine is the power-plant installation. The engines are the latest type Junkers Jumo 211 inverted vee-twelves with direct petrol injection and two-speed superchargers. This model gives about 1,200 h.p. for take-off. Airscrews are of the Junkers or V.D.M. constant-speed fully feathering type.

"The nacelles are of circular section and the radiator of each engine is of annular form, being housed immediately behind the airscrew, round the reduction-gear housing. This arrangement has been under development for over two years and is used in conjunction with a short radiator duct and controllable gills. Exhaust stubs, which discharge under the wing, are of the rearward-facing type and exert a measure of propulsive force.

"Each half of the undercarriage has two oleo legs and retracts rearward into the nacelles.

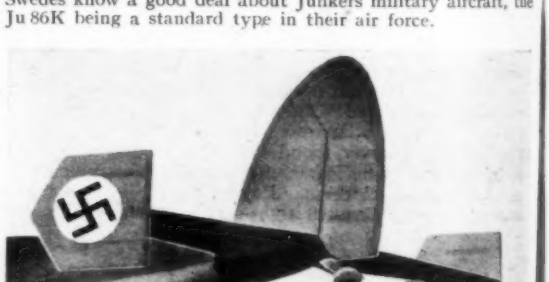
"Details of armament are unknown, but, being a fairly small machine the Ju 88 could effectively be fitted with fixed guns, say a pair of 20 or 23 mm. shell-guns. Doubtless there are, in addition, rearward-firing or downward-firing machine guns on free manually operated mountings. A typical bomb load would be about 2,500 lb."

This, until recently, represented more or less the sum total of our knowledge.

A few days ago a Leica enthusiast who was in Germany in June was showing us some coloured transparencies. One of these showed an aeroplane which had just taken off from the Junkers aerodrome at Dessau. At first glance it looked like a Heinkel He 111K, but when the transparency was projected it was evident that the machine was a Ju 88. It was like discovering a rare microbe under the microscope.

That little transparency has enabled "J. P." to make the above drawing. Complete accuracy, of course, still cannot be guaranteed, but it would appear that the nose of the machine is arranged like that of the Dornier Do 215, which was described in *Flight* of November 2. This means that the crew is accommodated in the nose and that there are gun positions above and below the fuselage as indicated.

We have heard that the Ju 88 now has auxiliary fins at the tips of the tailplane. On skimming through a Swedish publication the other day one noticed an advertisement for a metal manufacturing concern featuring a small sketch of a machine which had all the earmarks of a Ju 88. The tailplane, sure enough, had auxiliary fins which were shaped and arranged as shown in our small sketch. Possibly the sketch was not intended to depict the "88" at all, but was merely an artist's hypothesis. But one must not overlook the fact that the Swedes know a good deal about Junkers military aircraft, the Ju 86K being a standard type in their air force.



It has been said that the Ju 88 has auxiliary surfaces at the tips of its tailplane, as shown, but this is unconfirmed.

"ANTI-LOCO" MESSERSCHMITTS

AT the outbreak of the Polish war Poland had about a thousand machines, of which three-quarters were fighters and reconnaissance machines and the rest bombers. The majority of this force never left the ground, since from the start the Germans undertook the systematic destruction of all aerodromes within reach of the frontier, together with their ammunition and fuel supplies.

Having achieved command of the air (the Polish anti-aircraft fire being ineffective without fighter co-operation), the lines of communication of the Polish western armies were destroyed systematically and their retreat hampered. In this connection the Messerschmitt Me 110 twin-engined fighter armed with 20 mm. shell-guns was used to perforate the boilers of locomotives at the head of standing trains, the trains being subsequently destroyed by dive bombers. All such attacks were preceded by a detailed photographic study of the position.

As interesting as the employment of the Messerschmitts against railway engines was the utilisation of a group of Fieseler Storch slow-speed machines for the bombing of a wood held by the Poles and the opening of a way for German tanks.

November 23, 1939. Supplement to FLIGHT

THE AIRCRAFT ENGINEER

No. 166. (Volume XVIII No. 10) 14th Year November 23, 1939

GUN RECOIL

An Examination of Its Effect on Aircraft Stressing

By G. F. WALLACE, A.F.R.Ae.S

UNTIL quite recently gun armament was a Cinderella subject in aviation; aeroplanes were designed to be good aeroplanes first and last, and one or two guns were pushed in where convenient. With the coming of turrets, multi-gun aircraft, and the *canon*, far more attention has to be paid to gun installation, and structural design must be increasingly influenced by the needs of the gun and turret designers.

With the introduction of gun calibres exceeding .303in. in aircraft, the effect of the loads imposed by the gun will be of increasing importance in structural strength calculations. The loads due to the gun when firing are the weight, and a thrust, acting in the opposite direction to the movement of the projectile. There is also a torque reaction due to the spin of the projectile. With the type of gun likely to be used on aircraft in the near future, the energy of rotation of the projectile is of the order of .01 of the energy of translation, hence the torque can be safely ignored.

The loads due to the weight of the gun are the same as for any other item of equipment, but the treatment of the thrust, or "recoil" loads, calls for more special consideration. With weapons of .303in. calibre no difficulty was ever experienced in providing for the recoil loads, but no accurate figures for the recoil loads of the commonly used machine guns have ever been published.

Two of the main factors governing the recoil load imposed by any automatic gun are the ratio of the weight of the gun to the weight of the projectile, and the amount of the recoil absorbed in working the gun. In the .303in. calibre gun the ratio of the weight of the gun to the weight of the projectile is high, being of the order of 850 to 1. Also, in high-speed recoil-operated guns a fair proportion of the recoil energy is absorbed in working the gun. Hence the recoil loads imposed on the mounting are small, and mountings designed by eye are usually adequately strong.

As the calibre increases, the volume of propellant increases approximately as the cube of the calibre, and the recoil energy must increase pro rata; also for larger guns the ratio of gun weight to projectile weight must tend to decrease. For example, with a typical gun of .8in calibre the ratio of gun weight to projectile weight is 500 to 1 as against 850 to 1 for a typical .303 calibre gun. Adding the effect of these factors together, it will be seen that the recoil loads must increase as some power of the calibre. In increasing the calibre from .303 to .8 it is found in practice that the recoil load on the mounting increases 10 to 15 times.

The actual loads occurring in any part of a structure due to the recoil of a gun are not easy to determine, because they are impact loads and will vary with the flexibility of the structure. It is possible, however, to obtain some idea of the loads likely to be imposed on the points of attachment of the gun to the mounting.

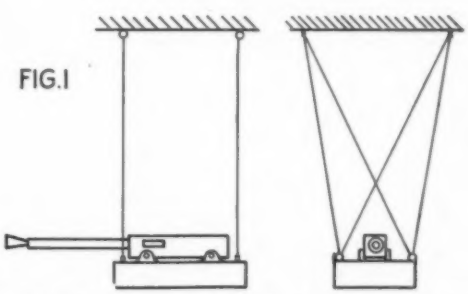
If a gun is free to recoil in its mounting then the momentum of the gun must be equal to the momentum of the projectile and gases leaving the gun. This is given by:—

$$M = (W_p + Kw)V \quad .. \quad .. \quad .. \quad .. \quad (1)$$

Where M = momentum of gun
W_p = weight of projectile
w = weight of propellant
K = constant
V = muzzle velocity of projectile.

The term Kw allows for the momentum of the gases ejected and is of the order of 25 per cent. of W_p. In guns fitted with a muzzle brake the gases ejected from the gun are deflected backwards and thus reduce the recoil of the gun. There is a limit to the extent to which the gases can be used for this purpose, owing to the effect of these gases on the structure and personnel behind the gun.

FIG.1



For weapons fitted with a muzzle brake equation (1) can be written:—

$$M \text{ (approx.)} = nW_pV \quad .. \quad .. \quad .. \quad .. \quad (2)$$

where n is between 1.15 and 1.2.

In recoil-operated guns M is still further reduced by the energy required to operate the gun. The actual value of M for any gun can be accurately determined by means of a ballistic pendulum, a diagram of which is shown in Fig. 1. This consists of a mounting suspended by wires. When the gun fires, the gun and mounting swing back and the amount of swing can be measured. When the angle of swing is small the velocity of recoil is:—

$$v_1 = \frac{2\pi\phi}{12 \times 60} \times d \quad .. \quad .. \quad .. \quad .. \quad .. \quad (3)$$

$$= \frac{\phi d}{114.7}$$

where v_1 = velocity of recoil
ϕ = period of pendulum in oscillations per minute
d = horizontal distance of recoil in inches.

Then the momentum of recoil is :—

$$M = v_1 W_1 \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (4)$$

where W_1 = total weight of gun and mounting.

At present this apparatus is in common use for the smaller calibres only.

Once the momentum of the gun is known the recoil velocity is given by :—

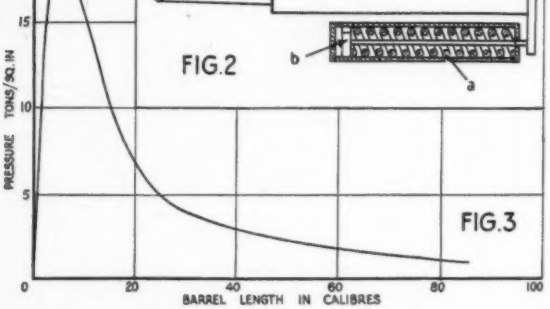
$$v = \frac{M}{W} \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (5)$$

where W is the weight of the gun.

The kinetic energy of the gun is :—

$$E = \frac{Wv^2}{2g} \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (6)$$

It is the dissipation of this energy that gives rise to the recoil loads in the mounting structure.



The conventional method of dissipating this energy is shown diagrammatically in Fig. 2. The gun, in recoiling, compresses the spring " a " and forces back the piston of the oil jackpot " b " ; the gun is run forward to its original position by the energy stored in the spring. If the recoil distance is d then the average load exerted on the mounting will be :—

$$U = \frac{E_1}{d} \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (7)$$

where E_1 is the energy stored in the spring.

The maximum value of U will depend on the proportion of the energy absorbed by the spring and oil jackpot ; in the worst case of a spring with no initial compression the maximum load imposed on the structure will be :—

$$U_m = \frac{2E_1}{d} \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (8)$$

It will be seen that the greater the recoil distance the smaller the load imposed on the structure.

Also, if the recoil distance be reduced to zero, the load on the structure becomes infinite. This, of course, cannot be true, and means that the equation $U = \frac{E_1}{d}$ only holds good for a limited range of values of d. If d is zero the gun cannot be accelerated to its recoil velocity and hence has no recoil velocity or momentum relative to the mounting. In other words, if the gun is rigidly fixed to the mounting, which in its turn is rigidly fixed to the aeroplane, then the force tending to accelerate the gun will accelerate the whole aeroplane and the momentum of the aeroplane backwards will be equal to the momentum of the projectile forwards.

The force accelerating the gun is the reaction to the pressure of the propellant gases accelerating the projectile up the barrel of the gun, and in the extreme case, when the gun is rigidly fixed to the mounting, this force is the maximum load that will be imposed on the mounting. Hence there are two extreme relations of the gun to the mounting :—

(a) When the gun is rigidly attached to the mounting.

(b) When the gun can recoil freely a sufficient distance to attain its maximum recoil velocity.

In the case (a), when the gun fires, the projectile is forced up the barrel by the pressure of the gases and the reaction to this pressure is transmitted to the mounting by the gun. This load is :—

$$P = P_a \times P_f \quad .. \quad .. \quad .. \quad .. \quad .. \quad (9)$$

where P_a is the force accelerating the projectile and P_f is the frictional resistance.

The work done on the base of the projectile by the gases must be equal to the energy of translation of the projectile as it leaves the muzzle, or :—

$$P_a l = \frac{W_p V^2}{2g} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (10)$$

where l is the length of the barrel.

The energy required to overcome the friction of the projectile is of the order of .1 of the energy of translation, so that approximately :—

$$Pl = 1.1 \frac{W_p V^2}{2g} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (11)$$

$$P = \frac{1.1 W_p V^2}{2gl} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (12)$$

This value of P is, of course, only the average, and the maximum may be considerably higher. The general shape of the pressure curve for a gun is shown in Fig. 3, and it can be seen that the maximum value of P would only occur over a short distance at the beginning of the movement. As the total time during which the load is acting is of the order of .005 sec., the average figure is accurate enough for practical purposes. This load P, then, is the maximum load the gun can exact on the mounting under any circumstances.

In case (b) the reaction to the load P will accelerate the whole gun in the opposite direction to the projectile until recoil velocity v (equation 5) is reached. In absorbing the energy of translation of the gun, the load U is imposed on the mounting as previously discussed.

As previously stated, U can be reduced by increasing the distance d. For automatic guns there is a definite limit to the recoil distance that can be allowed. If the rate of fire of the gun is R rounds per minute, then the maximum time that can be allowed for the recoil and return stroke is $\frac{60}{R}$ seconds. If the recoil distance is too great, the gun will recoil to the full extent on the first shot, but will fire before it has run forward again to its original position, and during automatic fire will only operate over a limited distance at the end of the stroke.

Effect of Flexibility

A short recoil distance means a stiff recoil buffer, and if the buffer is too stiff the load P will tend to be transmitted by a shock wave through the buffer, which in extreme cases will not compress at all. Hence, in practice, it is preferable in automatic guns to design the recoil buffer to store part of the recoil energy only, and to depend on the rest being dissipated in flexing the mounting structure.

If E_1 is the energy absorbed by the buffer, then :—

$$U_1 = \frac{E_1}{d} \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (13)$$

where U_1 is the average load on the mounting due to the compression of the buffer spring. The energy not absorbed by the buffer, $E - E_1$ must also give rise to loads in the mounting structure. These loads are not easy to determine and depend entirely on the flexibility of the structure. The amount of deflection in the structure during automatic fire will be governed by the rate of fire of the gun as discussed for the recoil buffers. In the most favourable case the maximum deflection that can occur must be such that the structure will deflect and return to its original position in the time $\frac{60}{R}$. Therefore the minimum load that can be imposed on the structure is determined by the rate of fire and is given by :—

$$p = \frac{M \times 2R}{60 \times 32.2} \quad .. \quad .. \quad .. \quad .. \quad .. \quad (14)$$

Therefore for any gun the loads imposed on the mounting structure cannot be greater than P or less than p, both of which can be estimated with reasonable accuracy.

Without a large number of tests on typical structures it would be difficult to say definitely whether the average aircraft structure is sufficiently flexible to give rise to the minimum load given by equation (14). It would depend also on the rate of fire of the gun. Any gun above .303in. calibre is certain to have a shock absorber of some sort fitted.

Consider the worst case in which the whole of the recoil energy is stored in the recoil spring, which has no initial compression. The maximum load imposed on the structure by the buffer is then $U_m = 2\frac{E}{d}$. By the time this load is reached, however, all the energy is stored in the buffer, and there is none available to stress the structure. This means that if the structure is flexible some of the energy will be used in deflecting the structure, and the maximum load U_m will never be reached. In other words, the structure is acting as a buffer, and the maximum load imposed by the buffer on the mounting will depend on the relative flexibility of the buffer and the mounting. In the case where the buffer absorbs only a part of the energy, the actual load imposed on the mounting by the buffer will probably be U_1, the maximum load in the buffer spring. With a gun fitted with a buffer and mounted on a flexible mounting the maximum load on the structure may be U_1 or p from equation (14). As the rate of fire increases, the percentage of the recoil energy absorbed by the buffer spring decreases, and the load p increases with rate of fire. Hence for a gun with a low rate of fire the maximum load imposed on the mounting would probably be U_1, while for a high rate of fire the maximum load would probably be p.

Data Required

When the projectile weight, gun weight, muzzle velocity, and load extension curve for the buffer spring are known, the loads are easily calculated and they should be sufficient for purposes of preliminary design. The actual load imposed by the gun on the structure in any particular case can only be accurately determined by firing tests.

When stressing the structure for this load it must be remembered that there is only a limited amount of energy available, and that the maximum load cannot be chased right through the structure, but will decrease progressively as the energy is absorbed in deflecting the structure. For any given gun and mounting structure, the loads will be constant within fairly close limits, and a factor of safety of 2 only is required.

It has been pointed out earlier that an increase in gun weight means a decrease in recoil energy. As, for various reasons, a high gun weight is preferable from the gun designer's point of view, it is sometimes argued that any decrease in gun weight is more than offset by the increase in recoil energy and consequent increase in structure weight. This is not so, however, because whereas the recoil load has a factor of 2, the weight may have a factor of anything up to 10.

Consider the hypothetical case of a gun weighing 100 lbs. and giving a load on the mounting of 1,000 lbs.

Vertical load = 100 × 10 = 1,000 lb.
Horizontal load = 1,000 × 2 = 2,000 lb.

Now assume that the gun is redesigned and has a weight of 200 lb., this will reduce the recoil load to 500 lb. The loads on the structure for stressing purposes will be :—

Vertical load = 200 × 10 = 2,000 lb.
Horizontal load = 500 × 2 = 1,000 lb.

Therefore the resultant load on the structure is the same as before but acting in a different direction. It is reasonable to assume that the structure weight will be the same in both cases, while with the heavier gun, 100 lb. is added to the weight of the aeroplane, hence the advantage is with the light gun in spite of its heavier recoil loads.

An Example

As an illustration of the methods described, of obtaining the loads imposed on the mounting structure, and to give some idea of the order of these loads, they are worked out below for a typical 20 m/m automatic gun.

Weight of gun = 145 lb.
Weight of projectile = .26 lb.
Muzzle velocity = 2,700ft./sec.
Barrel length = 4.5ft.
Max. rate of fire = 500 r.p.m.

$$\text{Velocity of recoil of gun} = \frac{1.2 \times .26 \times 2{,}700}{145} = 5.8\text{ft./sec.}$$

$$\text{Energy of recoil} = \frac{145 \times 5.8^2}{64.4} = 75.8\text{ft./lb}$$

The recoil buffer absorbs 40ft./lb. of the recoil energy, or over 50 per cent. The buffer has a travel of .75in. and an initial compression of 450 lb. Then the maximum load on the spring is 830 lb. approx. at the end of the stroke.

If the structure is flexible the minimum load that can be exerted by the gun is :—

$$p = \frac{1.2 \times .26 \times 2{,}700 \times 2 \times 500}{60 \times 32.2} = 436\text{ lb.}$$

If the structure is rigid and the recoil buffer is inoperative, then the maximum load that can be imposed on the structure is :—

$$P = \frac{1.1 \times .26 \times 2{,}700^2}{2 \times 32.2 \times 4.5} = 7{,}200\text{lb.}$$

The time during which this load acts is approximately :

$$\frac{4.5 \times 2}{2{,}700} = .0033\text{ sec.}$$

For preliminary design of the mounting the load of 830 lb. should be taken as acting at the point of attachment of the recoil buffer to the mounting. In a flexible mounting this load can be considered to decrease progressively to 436 lb. as it is chased through the structure.

Complexity

The Theory and Use of the Complex Variable. An Introduction. By S. L. Green. (*Sir Isaac Pitman and Sons*, 10s. 6d.)

HITHERTO students of the various branches of engineering and physics which demand a general knowledge of complex variable theory and its many applications have had only the classical mathematical treatises to which they could refer. There has, therefore, been a real need for a simple and clear exposition of the fundamentals of the subject which would make few demands on the mathematical technique of the reader. Mr. Green's small but comprehensive book successfully satisfies this need.

The first four chapters of the book deal with the theory of the complex variable, and the last four chapters deal with some of its applications. Conformal transformation is discussed in considerable detail, and a whole chapter is devoted to the important Schwarz-Christoffel transformation.

Complex variable theory does not, perhaps, play such an important part in aeronautical engineering as it does, say, in electrical engineering; nevertheless, the aeronautical student will find a knowledge of the fundamentals of complex variable theory essential if he wishes to understand fluid motion and aerofoil theory. Therefore, although Mr. Green makes only the briefest of references to the application of the complex variable to aerodynamics, he has succeeded in this book in providing the reader who is not a mathematical specialist with an introduction and background to much that is of considerable importance to aerodynamic theory. A. D. Y.

Steel Specifications

AN extremely useful wall card containing aero steel specifications has just been issued by Thos. Firth and John Brown, Ltd. The chart has been designed specifically for the technical and design departments of aircraft firms and should prove very handy for reference.

The chart is printed on both sides of the card, one side containing the steels arranged in "families" according to their application. On the other side of the card the steels are arranged in their numerical specification order, and their composition and mechanical properties given.

Application for copies of the chart should be made direct to Thos. Firth and John Brown, Ltd., Atlas and Norfolk Works, Sheffield, 1.

EXHAUST EFFLUX PROPULSION—II

By F. W. LANCHESTER, LL.D., F.R.S.

(*Continued from page 396d, November 16, 1939*)

IT has already been stated that there are two different conditions to be dealt with, that is to say two distinct problems to be solved. The first of these is that in which the full exhaust release pressure is utilised to impart energy to the efflux gases. The total energy available is represented by the "tail" of the diagram when the expansion graph is carried right down to the atmospheric line (Fig. 1). If there were no losses the whole of this energy would be represented as kinetic energy in the efflux gases: that is the initial assumption. Without doubt there would be considerable losses in portage and skin-friction in the discharge pipe; that will come up for discussion subsequently.

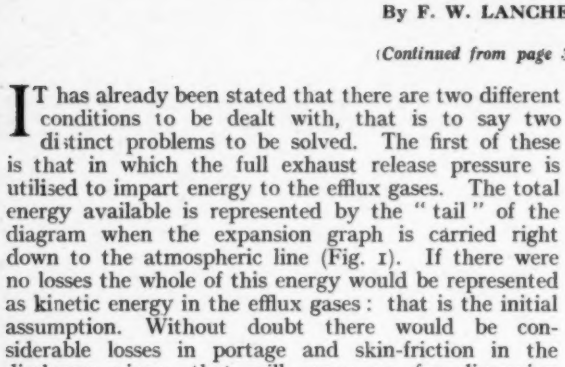


FIG. I.

It is important to set out with a clear understanding of the main conditions. When release takes place on the opening of the exhaust valve, the gases are expelled with a velocity primarily dependent upon the release pressure. In order to minimise loss the valve and guide and the exhaust port should be, so far as possible, streamlined (internally) to lead smoothly into the exhaust pipe, so that velocity once imparted to the issuing gas is not frittered away in eddy making or general turbulence. In practice the ideal at which to aim is that the only material loss of energy shall be due to skin-friction, such as is unavoidable. In the initial step all such losses are ignored.

Basis of Computation

The computation will be made on an arithmetical basis, *per one ton* gross weight of aeroplane.

Assume Gliding angle = 1/18,
hence drag = 125 pounds.
,, Propeller efficiency = 0.70 or 70%.
,, Flight velocity = 400 ft./sec.

Then, work done $= \frac{125}{0.7} \times 400 = 70{,}000$ ft. lb./sec.

Now in Fig. 1, between the diagram area ABCD and the "tail" area ADE, the relationship is fairly constant in different engines. The latter commonly represents an addition of about 20% to the diagram area; on this basis the contribution = 0.2 × 70,000 = 14,000 ft. lb. as that theoretically available. In order to calculate the theoretical efflux velocity we must ascertain the mass ejected per second. This is derived as follows:

1 lb. petrol contains 14,750,000 ft. lb. (lower value). ∴ 1 lb. charge may be taken as containing 1,000,000 ft. lb. At 25% brake thermal efficiency, 1 lb. charge = 250,000 ft. lb. Then, $\frac{70{,}000}{250{,}000} = 0.28$ lb. is the mass of the efflux gases per sec.

From this the efflux velocity may be calculated. Thus:

$v = \sqrt{2gs} = \sqrt{64.4 \times 14{,}000/0.28} = 1{,}795$ ft./sec.

This enables us to make use of equation (4) for the efflux efficiency, which must be based on the theory of the rocket. Efficiency $= \frac{2 \times 400}{1{,}795} = 0.445$, and so the energy available = 0.445 × 14,000 = 6,225 ft. lb./sec. as theoretically available for propulsion. This represents an addition of 0.088 in terms of the shaft h.p. delivered by the engine; in other words, an increase of 8.8%.

The writer has made a rough computation of the necessary loss due to skin-friction in the discharge pipe amounting to about 25% of the total theoretically available, and suggests provisionally that the whole loss should be taken as 50%; the energy available will then be 7,000 in place of 14,000 ft. lb./sec.; the mass ejected per second remains = 0.28 lb. and the velocity as before,

$$v = \sqrt{64.4 \times 7{,}000/0.28} = 1{,}270 \text{ ft. sec.}$$

Then efflux efficiency, eq. (4), $= \frac{2 \times 400}{1{,}270} = 0.63$ and propulsion energy available

= 0.63 × 7,000 = 4,410 ft. lb./sec.

which represents an addition of 6.3% to the h.p. delivered by the engine.

A Substantial Gain

Thus with a 50% allowance for energy loss due to "wire-drawing" at the exhaust valve and port, and skin-friction in the discharge pipe, the gain is very substantial. The flight velocity taken in this case as 400 ft./sec. is about that of a present-day chaser plane, though many such are capable of considerably higher speeds. If the same calculation be made based on a flight speed = 600 ft./sec. (other data unchanged) the result is materially better, as might be expected from the equation (4). Thus:

$$\text{Work done} = \frac{125}{0.7} \times 600 = 107{,}000 \text{ ft. lb./sec.}$$

and that represented in the "tail" of the diagram (Fig. 1) = 21,400 ft. lb./sec. Then Mass per sec.

$$= \frac{107{,}000}{250{,}000} = 0.43 \text{ lb.}$$

Then, $v = \sqrt{64.4 \times 21{,}400/.43} = 1{,}794$ ft./sec., and efficiency by (4) $= \frac{2 \times 600}{1{,}794} = 0.67$ and energy available for propulsion = 0.67 × 21,400 = 14,300, representing an addition of 13% to the h.p. delivered by the engine.

If we repeat this calculation on the basis of 50% loss as before, the figure is 9.25%. The comparison is:

$V = 400$ ft./sec. Gain* = 6.3%
$V = 600$ ft./sec. Gain* = 9.25%

So far the discussion has been limited to the theoretical aspect of the subject; the practical development is another matter. The ideal or best possible solution would appear to lie in the provision of a separate and individual exhaust pipe to each cylinder, connecting with a port overrun by the piston at about three-quarter stroke, that is at the usual point of release. This would allow of a very clean flow, undisturbed by obstacles, to

(*Continued on next page.*)

*Based on the assumption of 50% loss of energy.

EXHAUST EFFLUX PROPULSION (CONTINUED)

take place from the cylinder into the discharge pipe, and moreover give a rapid opening of the passage so that the loss in "wire drawing" during the early stage of discharge will be minimised. It would not be necessary in this disposition to insist on as many discharge pipes as there may be cylinders, so long as there is no overlapping; on the assumption that the period during which the overrun port is uncovered is less than 120 degrees, one discharge pipe would be sufficient for every three cylinders in a two-stroke cycle engine, or one for every six cylinders in the case of a four-stroke cycle engine. The proviso must be made, however, that the cylinders served in common are rightly chosen, and this may sometimes prove difficult; in that case the layout may involve the provision of independent pipes. The ordinary exhaust valve in the four-stroke cycle engine will, of course, be necessary to allow of the subsequent evacuation of the charge.

Next to this, but decidedly inferior from the present standpoint, will be to make use of the ordinary exhaust valve for both pressure blast and evacuation, but in this case the individual discharge pipe is almost essential, for with normal timing not more than two cylinders could be served by a discharge pipe in common: these two are those whose piston movements are in phase but whose cycles differ by a complete revolution. In any case, anything in the nature of manifold branching is open to the objection that such branches give rise to eddies and consequent loss.

When the release takes place a pressure wave is set up in the discharge pipe, which travels with the velocity of sound; this velocity, in the gases at high temperature, is very much greater than that with which we are familiar. It is difficult to assess with precision, because the temperature which at the instant of release is in the region of 1,000 deg. K. (i.e. 1,000 deg. C. absolute) is falling rapidly as the charge expands to atmosphere, but actually it must be in the region of 1,500 or 1,600 ft./sec. If the release be regarded as instantaneous a steep wave front travels with this velocity down the discharge pipe, and, as in Atkinson's system of scavenging, the length of the pipe has to be prescribed according to the speed of revolution of the engine: put colloquially, the length of the pipe has to be tuned to the engine speed. At this juncture the highbrow mathematician may be tempted to "step into the breach"; he is welcome. But the last word will be spoken on the test bench or in the air, and the writer believes that if the pipe length be such that the pressure wave-front will have just reached the outlet when the overrun port closes it will provide a good starting point or "kick off" for the practical investigator. In the case of an engine running at 3,000 r.p.m. of 50 r.p.sec.; the time period is then 1/150th second, and at 1,500 ft./sec. velocity the appropriate length of discharge pipe will be 10ft. In order that the highest efflux efficiency may be obtained when a compressed gas is being discharged to atmosphere it is necessary that the pipe which constitutes the outlet shall be of *increasing* diameter, in other words, bell-mouthed; not contracted. This is frequently described as an *evasé* nozzle. In the present case it suggests itself that the discharge pipe should be of gently expanding diameter from origin to outlet, but to settle this point would require a lengthy investigation for which much of the necessary data are unknown; the writer regards this and the question of the optimum diameter as matters to be settled by trial and error, a method which is sometimes quicker, less expensive, and more certain in its results than any other.

(*To be continued next week*).

SUDDEN DEATH OF WELL-KNOWN PILOT

Mr. H. W. C. SKINNER

BRITISH aviation has suffered a serious loss in the death of Mr. H. W. C. Skinner, chief test pilot to Phillips and Powis Aircraft, Ltd., of Woodley, Reading. Mr. Skinner died quite suddenly in his bath at his home on November 15.

Mr. Skinner was well known as a test and demonstration pilot, not only in this country but also abroad, where he had shown off to good advantage the various types of Miles aircraft. This applies more particularly to such countries as Holland, Belgium, Rumania, Latvia and Lithuania, where he had carried out some very convincing demonstration flights.

H. W. C. Skinner served as a pilot in the Royal Air Force, and on leaving the service he joined Phillips and Powis of Reading. He soon proved himself a very capable pilot, who knew not only how to get the best out of an aeroplane, but also how to "stage" his demonstrations so that the various points of the type being demonstrated were fully brought out. He became chief test pilot to the firm in 1937, and among the Miles types which he put through all their initial tests was the Master, the new training type with Rolls-Royce Kestrel engine, which is now being produced in large numbers for the R.A.F.

A personal appreciation of Mr. Skinner, by Mr. F. G. Miles, designer of the P. and P. machines, appears on p. 427.

"*Flight*" photograph.

The late Mr. Skinner about to start in a Miles Master.

The New MARENDA

Designed for Preparing the Pup Larger He Will Later

IT is very refreshing, in these times, to be able to place on record the production in this country of a new type of aircraft. To Mr. D. M. K. Marendaz falls the credit for having enabled *Flight* to publish a description of the first new British aeroplane of the war era. The machine is a two-seater trainer, and as the photographs show, it conforms to the popular conception in that it is a low-wing cantilever monoplane.

The Marendaz Trainer has been designed for bringing up pupils on a type of machine which will represent the larger and more powerful types which they will be called upon to fly later. Yet in spite of the fact that it is a low-wing monoplane, the designer has aimed at retaining in its features and characteristics the virtues of the biplane training machine. This has been aimed at by a careful choice of wing section, c.p. and c.g. position.

Structurally the Marendaz Trainer is a perfectly orthodox aeroplane, with stressed wooden skin, two-spar wing construction, and the usual small number of stainless steel fittings where highly stressed wooden parts are joined together. In the wing construction it is to be noted that the plywood covering extends over the whole wing area, i.e., one does not find the fabric covering aft of the rear spar which is so often used.

Any in-line engine of from 80 h.p. to 150 h.p. can be installed. The prototype has a Cirrus Minor, and the figures which follow refer to the machine so powered. The machine, it should be mentioned, will be marketed with a Fully Aerobatic C. of A.

The main dimensions of the Marendaz Trainer are: Length o.a. 22ft. 4in.; wing span 34ft.; wing area 157 sq. ft.: The weight empty is 960lb. and the loaded weight 1,500 lb. The disposable load includes pilot, passenger, luggage, 13 gallons of petrol and 2 gallons of oil. At a cruising speed of about 95 m.p.h. this gives a range of 350 miles. Extra tanks can be fitted to bring the range up to 700 miles. The wing loading is 9.5 lb./sq. ft. and the power loading 15.5 lb./h.p. With these loadings the maximum speed is in the neighbourhood of 124 m.p.h., the

The built-in wing tip slots are one of the modern features of the Marendaz Trainer.

An unusual type of undercarriage is fitted (left). The wheels roll sideways in a landing.

The three-quarter rear view on the opposite page brings out the clean lines.

Mr. D. M. K. Marendaz talks it over with his test pilot, Mr. R. A. Wyndham.

The spartan simplicity of the instrument panels has an appeal which is likely to be but temporary.

DA TRAINER

e Pup Larger and Faster Machines
Will by Later

stalling speed 37 m.p.h. and the landing speed 40 m.p.h. The initial rate of climb is claimed to be about 1,000ft./min., a figure which appears to be on the optimistic side in view of the relatively high power loading.

In order to avoid the complication of moving parts, Mr. Marendaz has used built-in leading-edge slots near the wing tips. These are of wood construction, with plywood covering and spruce formers. The steel plates at the wing roots are exceptionally long, a large number of bolts being provided so as to give adequate bearing area.

An unusual feature of the Marendaz Trainer is the type of undercarriage used. The legs are made of heavy-section square tubing, and the vee is attached at its upper ends to front and rear spars respectively, and swings laterally around a line joining these two points. At each point is a housing which holds a Silentbloc bush. The pins are 4in. long and of ¾in. diameter. At the apex of the vee formation is a third Silentbloc bush of large area, placed on top of a chrome vanadium stub axle, to which is secured a radius rod running up to the front spar of the centre-section. The rod is located in a housing which accommodates landing and rebound springs.

The two units of the undercarriage are independent, and the wheel track is exceptionally wide (93in.), so that one wing tip has to be 10ft. off the ground before the other touches, when the machine is standing on one wheel.

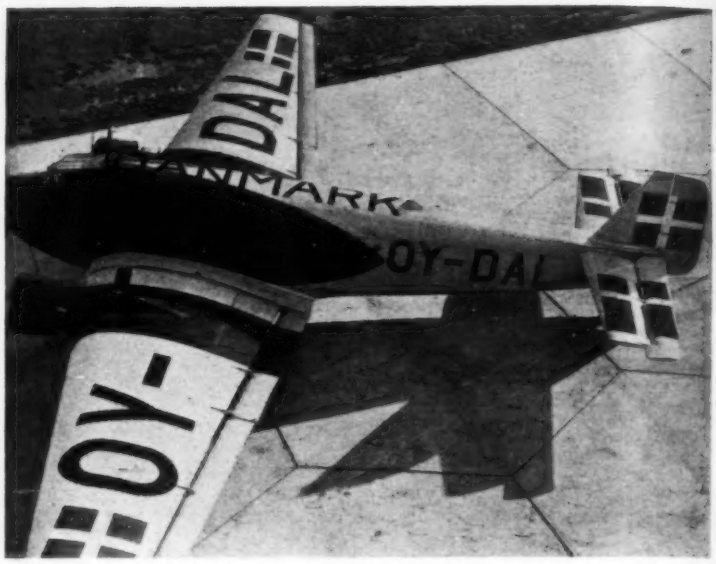
Another unusual feature is the tail skid, which is so mounted that the bottom of the fuselage can be covered, so that no dirt can accumulate inside. The skid is mounted on a full cantilever leaf spring of silicon manganese. At its centre point it is allowed to rotate around a Silentbloc bush. The forward end is attached to a bracket, and the flexing is accommodated through the medium of a roller.

The two petrol tanks are placed, one on each side, inside the centre-section stubs. They are interconnected, and all piping is so arranged that it does not pass through the cockpits. This makes for ease of inspection and also reduces fire risk.

Mention has already been made of the fact that the wing section has been carefully chosen. This includes consideration of absence of "float," usually a characteristic of a clean, lightly loaded, low-wing monoplane. If desired, flaps can be fitted, but Mr. Marendaz does not regard them as necessary for *ab initio* training.

COMMERCIAL AVIATION

"A. Viator" Discusses Many Things, a Few Serious Mixed Up With His Usual Delightful Nonsense



NEUTRALITY: A Ju. 52 of the Danish Air Lines used on the Copenhagen-Berlin route. The "Dannebrog" is difficult to mistake for any other flag.

"THE time has come," the Walrus said, "to talk of many things," and, in passing, I'd like to remark that you'd be better off as a walrus, a loan in the City, a basking shark, a duck-billed platypus or anything else that goes around on floats, than a mere wheeled aerial vehicle in these times of floods and deluges.

At some airports instructions before landing include, "Batten down the hatches, put on your inflatable life belts and prepare to swim; raise the periscope, don your goloshes and hope for the best, because the water comes right up over the top of the fuselage and may come in through the ventilators to the prejudice of good order and discipline."

What with gulls swimming around looking for fish, and tench, brill, chavender (or chub) and sprats mixing themselves up with the rainbow round the propellers, a life on the ocean wave has nothing whatsoever on a landing on one of our landlocked lakes, known officially to a lot of jolly lads who live on top of a dry hill in a western city as a civil airport.

By the Grace of God, and by kind Permission of Hitler, this sub-surface, a fathom or two below high-water mark, is hard, and the drainage is admirable in that all surface water flows under a bridge on the way to the airport and stays there, more or less permanently, if the presence of huge ancient pike biting at one's motor tyres in passing is any criterion. So I suppose we mussen grumble, and, as a matter of fact, we don't.

Navigational Assistance

But do you realise that in any sort of bad weather, we in civil aviation are up against a problem just as tough as anything we had to face immediately after "the Great War to Prevent this War," when we had no wireless and no sort of weather reports worth worrying about?

The only difference is that engines and instruments are more reliable now, but as far as navigational assistance is concerned, we are way back in the Dark Ages, and the equivalent social stage of development was a total lack of domestic sanitation and its attendant evils.

Those were the days when you had no option but to empty your slops into the street below from an upper window (crying "Out harrow and welawaye") upon some unfortunate bloke returning with guilty stealth from a party at cockcrow.

The bloke's name already stank in the nostrils of his lady wife anyway, and what with rolling pins being lead weighted and studded with nails in those days, it was usually a case of "habeas corpus, undertakerum sendus" before the normal excuses could be given and received.

What I mean is, nobody wants to return to those barbarous times, either socially or so far as civil aviation is concerned, and a little navigational assistance, however small, for incoming aircraft would raise the tone of things to a point where no social relapse need be expected. If not, for all I know we may slip back to the "slops from aloft" era, which would be awkward in the black-out and altogether a pity.

I note with interest that patched trouser seats became fashionable in Germany, "which," to quote some asinine Thugleiter, "proves that the necessities of the times are well understood." The fashion has caught on, too, I understand, in the very highest (or lowest) Nazi circles. Herr von Ribbentrop is said to have had his pants trepanned with bullet-proof steel the moment he saw Capt—beg pardon, Field Marshal—Goering wearing his spurs on his toes.

Danish Air Lines are now running an every-other-day service to and from Copenhagen via Amsterdam, and now that K.L.M. has two services a day there is a double connection from England to Copenhagen in the day.

The Danes are using, rather quaintly, the Focke-Wulf Condor for the job, but the service is running quite admirably up to now, and within a week or two it is hoped to turn this service into a daily one. Every-other-day transport never succeeds in aviation, which is too fast a means of transport for anything but regular daily travel.

Absurd Allegation

Just when there was a certain amount of tension in Holland, and, in fact, exactly at the least tactful moment, a couple of our more sensational newspapers produced a ridiculous story which might have led to disastrous results. It was as follows, and it seems to me to be monstrous that there is no censorship to stop this sort of incoming message from foreign correspondents:

"Bomb racks are being fitted to machines of K.L.M. Airways line." That was in one newspaper, and in the other there was a heading "K.L.M. planes as bombers," followed by "The famous passenger planes of the K.L.M. line were fitted with bomb racks."

These paragraphs appeared in British papers of the 9th and 10th November respectively, and I know for a fact, because I was in Holland and at Schiphol Airport at the time, that there was not a single word of truth in this absurd allegation. It was as much as to say that the aerial merchant ships of a neutral country were being, or had been, converted into armed merchantmen. The News Editors of the two journals concerned might reflect that

this paragraph gravely endangered the lives of passengers and crews on the normal services.

Figure for yourself the commotion which would be caused if a paragraph appeared in British newspapers to the effect that a certain neutral line of ships plying between this country and its own was being equipped with anti-aircraft guns, depth charges, and all sorts of other weapons.

Incidentally a recent passenger by K.L.M. was the 77-year-old Bishop of Gloucester.

Last week's sport included the bagging of one rabbit by a whole drove of Nazi sportsmen who visited the Shetlands. Another interesting item was the only bag of some would-be convoy raider, whose bombs destroyed a large cod-fish, subsequently rescued by a British ship and cooked for dinner.

Pity, since these raids have no other success, the poor German airmen cannot take their victims home with them, especially as there seems to be a shortage of food fit for human consumption.

So there is a new German plane capable of reaching England in 90 mins., eh? What the *Luftwaffle* wants to know is whether the thing will get back in 80 mins. should need arise, and also, incidentally, whether or no it falls to pieces in a dive.

A. VIATOR.

Clyde Pangborn

THIS well-known American pilot sailed for America on the "President Harding" on November 15.

Berlin to Moscow

A GERMAN civil aviation commission has arrived in Moscow to organise a new airline between Berlin and Moscow via Warsaw.

Weston-Cardiff Air Ferry Resumes

THE Weston-Cardiff Air Ferry will resume its services on Saturday, November 25, across the Bristol Channel. The line will run hourly in both directions.

K.L.M. Service to Scandinavia

THERE is now a daily K.L.M. service (weekdays only) from "an English aerodrome" to Malmö, via Amsterdam and Copenhagen. The departure from England is at 9 a.m. and the arrival at Malmö at 4.25 p.m.

K.L.M. to Run Fokkers Again?

IT is reported that K.L.M. will order four Fokker F24 airliners, thus breaking what, after several years, might almost be called their "American tradition." The F.24 is an all-metal twin-engined craft designed for 24 passengers.

Another Landplane Service to India

IMPERIAL AIRWAYS announce the doubling of the weekly landplane service between England and Calcutta. With the twice-weekly flying boat service to Sydney, and the augmented landplane service to Calcutta, there are now eight aircraft per week crossing India, as compared with ten before the war started.

Copenhagen—London

ACCORDING to the Danish aviation journal *Flyv*, Det Danske Luftfartselskab has succeeded in getting the concession for operating an airline between Copenhagen and London. The service will be operated with Focke-Wulf Condors, and the journal states that the route lies *via* Amsterdam "to Storeham, near Brighton." Even "A. Viator" dare not come that close to divulging the very secret aerodrome in England which is now the English terminus.

Stockholm to Perth Service

THE first trip on this route, by Swedish Airlines, will be flown on November 23.

Rome to New York?

A ROME wireless announcement stated that an Italian airline will shortly commence a fortnightly service from Rome to New York.

A Spot of Bother

THE Imperial Airways' liner *Dardanus*, which the Japanese forced down at Weichow on November 8, is now being repaired by them. A Japanese military aeroplane was sent to Hong Kong for a tyre and other material. Mails, which included official packets, were being closely examined by the Hong Kong authorities, but it is believed that the *Dardanus* will be released as soon as repairs are completed. The British Consul has so far been unable to obtain an interview with the pilot, who is being held for questioning.

Scandinavia—Berlin

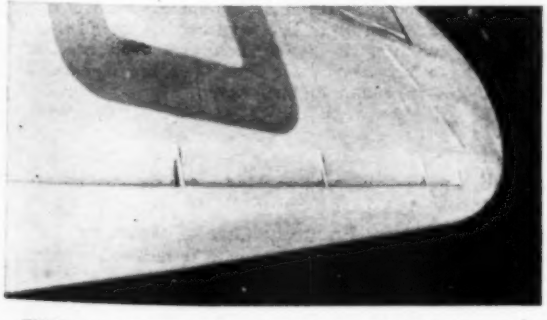
THERE are now two daily services between Copenhagen and Berlin, one operated by Det Danske Luftfartselskab and the other by A. B. Aerotransport (The Swedish Air Lines). Only the latter calls at Malmö on its way to Stockholm. The Danish line does not, as we recently stated, run to Malmö.

Incidentally it may be added that the Danish company's Ju.52 leaves Kastrup at 10 a.m. and the passengers arrive in Berlin at 12.15, having been put down at Rangsdorff aerodrome, south of Berlin.

Only neutral civil aircraft operate between Scandinavia and Berlin.

New York's New Airport

THE New York Municipal Airport was opened—sorry, Americans, "dedicated"—on October 16 before 150,000 spectators—or, as we should say, a large crowd. Being both flying-boat base and aerodrome it seems to be what an airport should be. (One is reminded of the Fisherman's Bend site at Melbourne which presents a wonderful opportunity for that city to make both flying-boat base and aerodrome together very close to the centre of the city.) The "dedication ceremonies" included fly-pasts by T.W.A. airliners and Pan American's Atlantic Clipper. The area of the aerodrome, which is supplied with runways at 45 deg., is 558 acres. Photographs of the ceremony and the airport were given in last week's issue on pages 406 and 407.



FIXED SLOTS FOR THE CHILTON: Differing from the usual "built-in" slots, this type also has been found effective in preventing wing-dropping at the stall, unless extreme rudder is used. The top speed is unaffected, and the handling qualities, including aerobatics, are unchanged.

LET'S BE OLD-FASHIONED

A Word About Past Virtues : Thoughts After a Trip in a Semi-obsolescent Fighter

WHEN and if this war really starts—and provided there is no successful *Blitzkrieg* to shorten it—there may be some interesting discoveries both about aerial tactics and types. In peacetime, working very largely on theory alone, the natural development is towards faster and more heavily armed machines—bombers to escape the fighters, and fighters to catch the bombers. A vicious circle.

To stress the obvious, no bomber is going to turn round and fight; therefore what the Americans more logically term the "pursuit ship" must be made fast enough to catch it. That principle is not likely to change, but for routine work over the lines the future of design is unpredictable. There the fighters must keep the sky clear for the observation and co-operation machines and everyone must turn and fight. In such conditions the slower, though well-armed and agile, type can stand as good a chance as any other—depending on circumstances. Even the slowest type is by no means cold meat so long as it has guns and sheer manœuvrability. In the last war even the old F.E. 2bs contrived to survive against much superior fighters so long as they were not taken by surprise and had time to arrange themselves into a circular line-ahead formation—turning and turning until the enemy became tired of diving on the equivalent of the army "square" of long ago.

Biplane Bliss

All of which is the rambling of a mere innocent in such matters and the effect of a form of wish fulfilment. The other day I had a chance of flying one of the old-type fighters. The words "old-type" in this case are somewhat silly, since this particular machine, a Gladiator, was a first liner until a year or two ago, and will still do good work of its own kind. It was so pleasant to fly, this cleaned-up biplane fighter, that I should hate to think that its active days would ever be over. Wish fulfilment or not, I don't think they will be, in this war.

It was nothing less than a rest cure to fly a machine in which there were comparatively few taps and which, one felt, could be put down in any decent field without too much difficulty. Very little more complicated and every bit as easy to fly as a Tiger; in fact, it was like a good light aeroplane, and it was hard to realise that out in front was just nine times the power. With all its wings, struts, and fixed undercarriage it murmured along at a pleasant 180 m.p.h. on less than half throttle—though I've long since ceased to think in terms of throttle, but only of boost and revolutions.

The weather was comparatively bad, with a good deal of rain and lowish cloud, but after two minutes in the air I decided to fly a straight-line course to my objective. Admittedly, I was late for an appointment, and only the higher hills were in the clouds, but in almost any other modern type, flown at least for the first time, I should have followed low ground by devious routes. Here it was, something that could be handled and which did not require complicated operations before approaching to land.

But the real answer to the question of why I felt happy was that one little word "sideslip." Very old-fashioned and very comforting. Sometimes I wonder if the old-timers will ever forget the happy days when fields or aerodromes could be approached high, bank put on and top rudder applied to lose a magical five hundred feet without effort, worry or risk.

Of course, the application of acres of flap produces the same result even more effectively, but, while a sideslip is instinctive, immediately stopped, and obtainable with the help of the same three controls which are always in use, a flapped approach involves engineering efforts, and, once started, must be carried through to the end. Even if flaps *could* be raised with safety—say, on the Miles Monarch principle—it is still another control to make a scientist out of a birdman. In a tight corner you cannot always think scientifically, and the flying is then done by instinct.

Joyful Sideslips

We who learnt and were brought up on biplanes will never forget the real joy obtained from a successful sideslip approach into a tiny field. Just before the war started I took up a Tiger after a comparatively long bout of modern-type flying, found a square field three hundred by three hundred, and attacked it from half a dozen different angles. All the accurate motoring in fine pitch cannot compare with the sense of achievement following an approach in which the slip is straightened out with the hedge three feet below one's wheels. Here's to the cleaned-up biplane with all its faults.

Faults there are. After low-wing types the view appears to be incredibly bad. Wherever one looks there is a centre-section (however thin), a top wing, a set of struts, or a large radial engine, and when approaching a busy aerodrome one tips the aeroplane furiously about in an attempt to find an Anson, Hurricane or Oxford which has hidden itself somewhere. Yet even this view business is a matter of custom. A few hours in such a type as the Gladiator and you wonder why a complaint was ever made; you merely learn to know where and how to look. Nobody ever complained about the view from the back seat of a Moth—but the skies were not quite so crowded in the days when we toured gently about in the somewhat cramped cockpits of these excellent aeroplanes. We have simply become used to the idea of being able to see everything above and more or less ahead; though why it should be more important to see above than below is not easily proved. Once upon a time we thought the high-wing monoplane provided the best view. Times change. They will again.

* * *

One of the better moments: After fighting a heavy bomber in very bumpy weather for forty minutes, to find that the undercarriage and flaps must be pumped down—and no human assistance available. Not so many pump strokes as there are turns of the handle with a certain medium-sized twin type, but hard enough for all that. I was, in this case, the available human assistance, but I might have been anywhere else and the undercarriage would still have had to be lowered.

INDICATOR.

Swedish Civil Aviation

A SUCCESSFUL year is reported—up to September 1st. For this eight months A.B.A. (Swedish Airlines) carried 50,582 passengers, an increase of 20 per cent. over the corresponding period for 1938.

But the increase in "passenger-kilometres" is even greater—from 9 million to 14 million, an increase of 52 per cent. All freights show increases also. The route to Berlin was extended in the summer to Zurich and a line was opened between Stockholm and Helsinki. The routes from Stockholm to Paris and to Moscow have been kept open for six months instead of three.

Moving Privately Owned Aircraft

OWNERS of civil aircraft who wish to remove their aircraft to another location for storage must obtain a Permit to Fly. Applications should be addressed to the Director-General of Civil Aviation, Air Ministry (O.S. Ops.), N.A.C. Headquarters, 25, Julian Road, Bristol, 9. The particulars to be given in the application are given in Notice to Aircraft Owners and Ground Engineers, No. 32, of 1939.

SERVICE AVIATION

Royal Air Force and Official Announcements

ADVANCED TRAINERS: Flying training schools are now receiving batches of Miles Master I advanced training monoplanes with Rolls-Royce Kestrel XXX engines. These machines are not only fast and "easy on the eye" but reproduce more nearly than any comparable type the characteristics of the modern fighter.

Casualties

THE Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—F/O. R. Williams.

MISSING, BELIEVED KILLED IN ACTION.—P/O. A. D. Baird, P/O. G. B. Mitchell.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—Flt. Lt. W. F. Barton, F/O. N. C. Beck, A/Sgt. E. B. Hillier, A/C.2 S. Isherwood, Sgt. S. G. McK. Otty, Flt. Sgt. A. J. Turner.

KILLED ON ACTIVE SERVICE.—A.P/O. E. W. Allinson, A/C.1 J. C. Bailey, L.A/C. W. G. Bowman, A.P/O. G. H. H. Coates, P/O. J. D. Cody, Sgt. E. J. Cole, A/C.2 E. Duff, F/O. A. O. Glover, L.A/C. S. Hawkins, A.P/O. J. G. L. Haig, Sgt. A. H. Harris, Sqn. Ldr. L. S. Lamb, A/C.1 E. W. Looker, P/O. J. Lingwood, Flt. Lt. J. P. Marriott, A/C.2 L. J. Penteny, F/O. E. K. Rayson, P/O. D. H. Robertson, P/O. D. K. Robertson, Sgt. H. G. Sillence, Sqn. Ldr. C. Thripp, A/C.1 W. Watson, A/C.2 F. J. Wilkes.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—P/O. J. W. Boreham.

MISSING.—Sgt. R. A. Bigger, Sgt. E. H. Crellin, F/O. D. F. Elliot, P/O. W. G. McCracken, Sgt. S. McIntyre, L.A/C. A. J. Saffin, A/Flt. Lt. J. M. E. Sinclair, A/C.2 F. A. Twinning.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—P/O. R. M. Coste, Sgt. R. L. Galloway.

DIED ON ACTIVE SERVICE.—Sgt. H. G. Beer, A/C.2 E. W. Brogden, L.A/C. J. R. Banks, F/O. R. P. S. Davidson, A/C.2 E. P. French, A/C.2 A. N. McQuade, A/C.1 F. Reed, Cpl. E. Stevenson.

One Thousand Canadians

ACCORDING to information from Canada there are now 1,000 Canadians on active service with the R.A.F. in France, most of whom paid their own expenses to England to join the British Forces.

Postal Rates to Forces in France

THE War Office and Air Ministry announce that attention is called to the fact that the postal letter rate for correspondence to men on active service in France is only 1½d. per ½oz.

Use of Clubs

TO the London clubs offering officers of H.M. Forces temporary honorary membership is added the Junior Constitutional Club, Piccadilly, W.1. Last week mention was made of similar facilities offered by Queen's, Roehampton, and the Lansdowne clubs.

The Berkshire Downs Range

CONSENT has been refused by the Berkshire County Council for the Air Ministry to use part of the Berkshire Downs, near White Horse Hill, as a bombing range. They had been informed by the Air Ministry that the range would be needed for night and day practice at all times of the year. The Chairman of the Council said that the particular part of Berkshire required was very precious to them, containing as it did ancient historical monuments which were a matter of interest to visitors from all over the country. The Air Ministry had powers to take the land if they liked but it was hardly fair of them to ask the Council to concur in what the Chairman described as "the desecration of this most beautiful spot on the Berkshire Downs."

Hurricane Performance

IN *Flight* of June 8 this year figures were given for the performance of the Hawker Hurricane I single-seater eight-gun fighter flying at an all-up weight of 6,180lb. and using a fixed-pitch airscrew. The speed at 17,500ft. was given as 330 m.p.h. and the climb to 20,000ft. as 9½ minutes. Most Hurricanes are now fitted with the De Havilland two-position controllable-pitch airscrew which increases the weight to 6,380lb. The top speed is very much the same but the take-off is much improved. The time of climb to 20,000ft. is about 10 minutes.

Later Hurricanes are being fitted with the Rotol constant-speed airscrew which gives approximately the same speeds. Although the all-up weight is about 6,300lb. the time of climb to 20,000ft. is reduced to less than 9 minutes. The take-off is quite phenomenal for a monoplane fighter, being less than 200yd.

Volunteer Reservists on Leave

ATTENTION has been drawn in some sections of the Press to the case of numbers of members of the R.A.F. Volunteer Reserve who were called up on the outbreak of war, but have not yet been employed in the Service. They have been given leave on full pay until further notice, and this has been represented as a waste of public money.

The Air Ministry has pointed out that on the outbreak of war all Reserves and Auxiliary forces are at once embodied as a matter of course, and that in this case it would have been invidious to have omitted the R.A.F.V.R. Some members, especially pilots, observers, air gunners, and mechanics, who were sufficiently trained, were needed at once and were posted to stations. For the rest, a certain number of Initial Training Wings were shortly established. It would have been possible to set up more of these I.T.W.s so as to absorb the full number, but there were reasons against taking this step. For one thing, it was expensive to commandeer buildings and assemble a staff of instructors, as well as arranging for caterers and so forth, especially as most of the Wings would only have been needed for a short time. However, one more I.T.W. is now being established, and another is in contemplation.

But even if all the Volunteer Reservists had been put in training at once, a delay would still have been inevitable, though it would have occurred at a later stage of their training. The governing factor was the capacity of the regular Flying Training Schools to accept pupils for intermediate and advanced instruction. They immediately started

Service Aviation

working to capacity on a war basis, and it was thought better to give leave on full pay to the remaining V.R. men until they could be sent straight through the course of I.T.W., Elementary F.T.S., and regular F.T.S.

The numbers on leave have now been very largely reduced, and it is expected that all will have been sent to I.T.W.s by the end of the year. Ultimately the organisation in Canada will be able to provide intermediate and advanced training for as many pilots and observers from all over the Empire as may be required during the war.

Royal Air Force Gazette

Royal Air Force

Air Ministry, November 14.

General Duties Branch.

Sqn. Ldr. G. H. Gatheral is granted a permanent commission in that rank (Nov. 1).

The following Flight Lieutenants are granted permanent commissions in that rank (Nov. 7):—C. C. Hodder, P. S. Hutchinson, R. G. Seys, D.F.C.

The following are granted permanent commissions as Pilot Officers with effect from Oct. 21, and with seny. of the dates stated:—P. J. Carpenter, R. Gray, R. W. H. Stevenson (Jan. 21, 1938); E. A. H. Chapple (July 21, 1938).

The following Pilot Officers on probation are confirmed in their appointments on the dates stated:—A. J. Smith, P. V. Lockett (Sept. 27); A. Hughes (Oct. 3); J. M. White (Oct. 6); D. O. M. Browne (Oct. 17); E. A. Vagg, A. Stewart (Oct. 18); R. L. H. Harris (Oct. 21); D. Redington (Oct. 22); E. J. Wilcox (Oct. 24); K. V. Gilling, C. J. Hitch, W. M. R. Smith (Oct. 25); W. S. F. Brown (Oct. 26); S. Baker, W. G. Bibby, J. H. Grimes, J. A. Woollen (Oct. 29); R. E. C. J. Beeny (Oct. 30); E. A. Allan, C. J. Allsup, R. J. Bailey, P. P. C. Barthropp, C. A. Bird, J. R. Bloxam, A. H. C. Boxer, A. J. Bradley, B. W. Brown, E. H. Brown, H. F. Burns, R. M. Coles, T. P. M. Cooper Slipper, R. M. Coulman, F. S. Crawford, D. P. Crittall, V. G. Daw, R. W. Dodd, A. F. Eckford, N. D. Edmond, A. L. Edy, A. G. Egerton, R. G. English, P. J. S. Finlayson, B. F. Fitz-Gibbon, R. B. Fleming, K. C. Forsythe, P. R. Fowler, J. H. T. Foxton, R. L. Fulier, H. Gore, R. D. Grassick, R. C. Lloyd, D. A. J. McClure, H. J. McGlymont, S. R. McNamara, A. C. Manston, C. Marshall, A. R. Mathias, G. J. Menzies, J. P. Middlehurst, R. F. Milne, J. S. Mitchell, H. L. North, W. E. Ogle-Skan, A. B. Parker, J. C. Paterson, P. C. Piéjus, P. H. S. Pilcher, G. E. Pittman, M. E. Pollard, C. D. Regan, M. V. Reynolds, D. J. Sanders, G. C. Saunders, H. A. G. Smith, G. McK. Stewart, C. M. B. Symons, P. M. Townshend, S. H. Troughton-Smith, P. S. Turner, P. K. Vartan, A. Warburton, J. C. Ward, P. V. Watson, A. I. Watterson, A. H. M. Wright, G. A. Yapp (Oct. 31).

The following Acting Pilot Officer on probation is confirmed in his appointment and graded as Pilot Officer on the date stated:—F. R. Ainley (Aug. 16).

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers (Aug. 29):—D. G. Cobden, G. C. Conran, A. H. Harding. (Substituted for notification in the *Gazette* of Oct. 10.)

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—D. C. F. Coutts, G. G. Crawford, J. Falkson, J. M. Gilmer, D. L. Harvey, E. J. Keeble, P. H. Purdy, H. D. Wardle (Sept. 23); N. A. R. Doughty, K. C. H. Jacobs, P. McL. Peace (Sept. 30); R. C. F. Finch (Sept. 27); G. J. Cox (Oct. 2).

Acting Pilot Officer on probation J. P. Anderson (since deceased) is graded as Pilot Officer on probation (Sept. 23).

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—P. J. H. Harrington (Sept. 6); J. MacDougall (Capt., The Duke of Cornwall's Light Infantry), W. G. Tailyour (Lt., The Queen's Own Cameron Highlanders), I. C. B. Worthington-Wilmer (Hon. Flt. Lt.) (Capt. The Royal Tank Corps) (seny. Sept. 14, 1938) (Sept. 14); J. B. Russell, A. D. C. Fair, G. V. Fryer, R. N. Wardell, L. E. Cryer, D.F.C., N. A. N. Bray, D.F.C., J. A. Kent, A.F.C., M. M. J. Stevens, D. K. Banks, E. H. T. Thwaites, A. J. Trumble, J. Vivian, C. S. Darwood, T. M. Evans, R. L. Smith, S. Dodds, J. R. Wilson, J. Ricy, F. M. Thomas (Sept. 15); F. W. Flood, G. E. Horne, H. D. Newman, V. Ray, G. H. Sheehan (Sept. 21); R. H. Humphries (Capt., The Prince of Wales's Volunteers) (seny. Sept. 22, 1938) (Sept. 22); H. A. R. Holford (Sept. 29); J. W. S. Forbes (Oct. 4); W. E. Selkirk, T. W. C. Fazan, E. F. Pippet, A. L. Bocking, P. F. Edinger, E. B. Jupp, E. J. C. Michelmore, R. Williams, A. B. Olney, P. D. R. Hutchings, A.F.C., D. I. C. Eyres, O. R. C. Moseley, G. F. Lerwill, P. A. Lombard, C. M. Lester, A. M. Smith, G. E. Hawkins (Oct. 15); W. Townson, E. L. Hyde, J. Rankin, J. B. W. Smith, G. A. L. Cheatle, P. G. Heath, P. H. Bragg, G. H. N. Gibson, R. B. Harvey, J. A. C. Karran, R. D. Stubbs, C. H. Jones, C. J. K. Hutchins, A. G. T. James, C. A. Masterman, P. C. Pinkman (Oct. 16); N. W. Wright (Oct. 21); D. S. MacDonald, J. A. Richards (Oct. 24); J. H. Barrett (seny. Feb. 4) (Nov. 4); F. C. Phipps, H. F. Thomson (seny. Aug. 4) (Nov. 4).

The following Pilot Officers are promoted to the rank of Flying Officers on the dates stated:—A. F. Johnson, R. F. Watts (seny. Sept. 4, 1938) (Dec. 4, 1938); W. S. Bowyer, F. J. Howell (Sept. 1); J. J. K. Fleetwood, R. G. Le Dieu (Sept. 3); W. J. Woods (Sept. 4); R. F. Clarke, W. M. Nixon, W. H. Nelson, J. A. Sproule, T. O. Marshall, H. V. Smith (Sept. 8); A. M. Young, D. J. French (Sept. 10); J. A. Slater, E. F. Nind, R. P. Nelms, J. K. Rogers, E. H. Dean, K. P. Smales, W. V. Gordon, C. W. Poulter, F. R. M. Williams, A. J. Handley (Sept. 19); R. Lloyd (Sept. 17); C. A. C. Stone, M. A. Snowball, G. E. P. Green (Sept. 19); J. D. W. Murray, J. A. Pimlott, P. A. Wimberley, P. F. Illingworth, J. M. Strickland, P. R. Barr, D. L. Vercoe, B. Statham, I. N. Bonard, J. G. Howard, R. D. C. Chambers (Sept. 21); W. B. Keddy (Sept. 25); J. D. V. Forter, J. A. F. MacLachlan, R. A. Kellow, P. H. Way, G. L. Sinclair, W. G. Jex, J. P. Trewby, L. A. McSherry, P. R. O'Connor, R. P. Elliott (Oct. 1); J. A. B. Dobson (Oct. 4); P. H. Woodruff, J. R. Appleton, D. F. Beardon, R. M. J. Cowles, J. F. Hyde, J. A. A. Read, W. S. Herd, F. E. W. Birchfield, D. H. Edwards, M. K. Carswell (Oct. 5); D. B. Esmonde-White, A. F. Dodge, J. R. St. John, J. H. M. Chisholm, D. R. Gamblen, J. W. Lydall, P. H. A. Simmons, J. H. Marks, B. G. Meharg, J. F. Ritchie, K. N. G. Robinson, J. E. Turner, V. Wiatkin, O. St. J. Pigg, T. E. Sanders, B. G. Haylock, E. G. Scott, A. F. Sunderland-Cooper, A. F. Binks (Oct. 8); A. M. Campbell (Oct. 9); G. D. L. Haysom (Oct. 11); R. G. G. English, E. E. A. Wood, M. Booth, A. P. Philipsen, N. Hawxby, G. B. F. Cousens, R. N. Chudleigh, E. D. Griffiths, C. L. Monk, H. N. Burrows, M. I. Freeman, P. F. Templeman, A. T. Rose-Price, W. P. Copinger, I. L. McG. Hallam, W. D. L. Filson Young, R. V. Meredith, R. S. Crawford, H. A. Smith, R. N. Collins, W. A. C. Emmett, D. B. Brooks, G. R. Grattan, B. G. F. Drinkwater, G. F. Irving, J. E. Carter, D. Blew, N. J. Robertson, A. J. O Jeffrey, H. W. Robson, J. C. Stevenson, J. D. Rochfort, R. P. Plummer (Oct. 15); A. B. Lennie, J. W. Villa (Oct. 26); H. H. Knight, A. B. Mobley (Oct. 27).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—L. G. Burnand (July 15); C. H. Fry (Aug. 9); C. S. F. Wood (Aug. 14).

Air Vice-Marshal Sir T. I. Webb-Bowen, K.C.B., C.M.G. (R.A.F., Ret.), relinquishes, at his own request, the rank of Air Vice-Marshal while re-employed with the Royal Air Force and is granted the rank of Air Commodore (Oct. 2); P/O. C. B. Jordan takes rank and precedence as if his appointment as Pilot Officer bore date May 24, reduction to take effect from Oct. 16; F/O. T. F. T. Chambers relinquishes his short service commission on appointment to the Indian Army (Oct. 23); Sqn. Ldr. I. O'B. MacGregor (Maj., R.A.) relinquishes his temporary commission in the Royal Air Force on return to Army duty (Oct. 31).

Equipment Branch.

The following Warrant Officers are granted permanent commissions as Flying Officers on probation with effect from the dates stated and with seny. of Sept. 18:—G. R. C. Baker (Oct. 20); A. Paton (Oct. 31).

Flight Lieutenant on probation F. A. A. H. Strath is confirmed in his appointment (Sept. 27); F/O. W. Dalton is placed on the retired list on account of ill-health (Nov. 9).

Accountant Branch.

F/O. H. S. Maurice-Jones is granted the acting rank of Flight Lieutenant (Aug. 18).

Legal Branch.

Wing Cdr. E. St. C. Harnett, C.B.E., is promoted to the rank of Group Captain (Sept. 4). (Substituted for notification in *Gazette* of Oct. 20.)

Commissioned Engineer Officers.

The following Flying Officers are promoted to the rank of Flight Lieutenant (Oct. 26):—R. Best, D. T. McKeown.

Commissioned Armament Officers.

The following Warrant Officers are granted permanent commissions as Flying Officers on probation with effect from the dates stated and with seny. of June 19:—A. T. Jones, M.M., H. L. Whitlock (Oct. 15); W. R. Hardeman (Oct. 17); G. O. Thomson (Oct. 30).

Commissioned Physical Training Officer.

The notification in the *Gazette* of Oct. 10 concerning Warrant Officer J. S. Lancaster is cancelled.

Erratum.

In the *Gazette* of Sept. 26 notification concerning E. F. Hawkins for Sept. 5 read Sept. 4.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

F/O. H. J. Wykes is granted a commission in class CC as Flight Lieutenant (July 26); Flt. Lt. (Hon. Sqn. Ldr.) J. Everidge, M.C. (Sqn. Ldr., R.A.F., Ret.), is granted the rank of Squadron Leader in class CC (May 1) (substituted for notification in *Gazette* of Sept. 19)

The following relinquish their commissions in class CC on appointment to commissions in the Royal Air Force Volunteer Reserve (Sept. 1):—Squadron Leader.—J. E. M. Atherley. Flight Lieutenant (Acting Squadron Leader)—A. J. Nightingale. Flight Lieutenants.—E. J. Dease, H. G. Travers, D.S.C., L. J. Woollam, A. H. Dalton.

The following relinquish their commissions on cessation of duty on the dates stated:—Flight Lieutenants.—E. V. Major (Sept. 4); J. M. Wintour (Sept. 15); H. J. Hasler, M.C. (Nov. 1). Flight Officers.—H. P. Sears (Aug. 24); C. A. R. Gibb (Aug. 29); H. S. Cooper (Sept. 15).

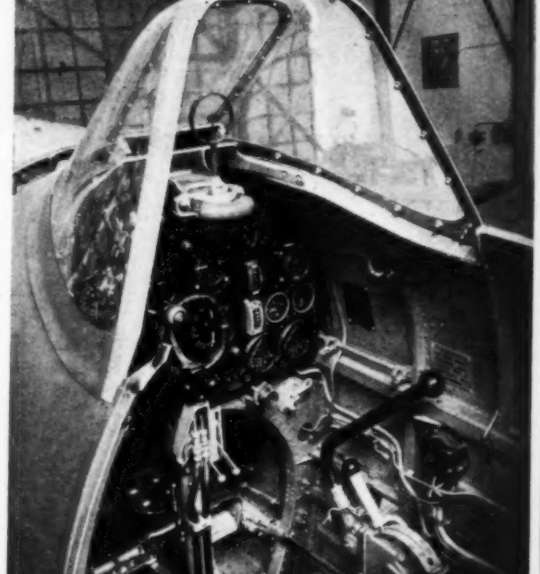
Equipment Branch.

The following Flight Lieutenants relinquish their commissions in class CC on appointment to commissions in the Royal Air Force Volunteer Reserve (Sept. 1):—P. H. Hunter, W. H. Scott-Badcock, G. W. Hobbs, G. F. Mulholland.

Royal Air Force Volunteer Reserve

GENERAL DUTIES BRANCH.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—G. W. Alexander (Oct. 5); R. L. Neale (Oct. 19); P. C. Hoyle, M. H. Seymour (Oct. 28).



FIRE-SPITTING DEPARTMENT: A peep into the cockpit of a Supermarine Spitfire I single-seater eight-gun fighter. This is the fastest military aircraft in service in any appreciable numbers in the world.

THE CAMOUFLAGE CULT: A production-type Bristol Beaufort multi-purpose monoplane as now being introduced into squadrons of the R.A.F. It has been stated that this machine is appreciably faster even than the Blenheim Mk. IV, which means that it does 300-and-some m.p.h. The engines are small-diameter Bristol Taurus sleeve-valve radials. Beauforts are to be built on a large scale, not only in England, but in Australia.

The following Pilot Officers resign their commissions on the dates stated:—D. F. O. Shelford (Sept. 16, 1938); R. C. L. Brayne (Oct. 24).

P/O. R. Gray relinquishes his commission on appointment to a permanent commission in the Royal Air Force (Oct. 21).

Administrative and Special Duties Branch.

The following are granted commissions in the ranks stated with effect from September 1 and with seniority of the dates stated:—Squadron Leaders.—Flt. Lt. A. H. Dalton (March 27); Flt. Lt. A. J. Nightingale (R.A.F.O.) (June 10); Capt. J. E. M. Atherley (Aug. 19). Flight Lieutenants.—E. J. Deane (Sept. 20, 1938); Flt. Lt. L. T. Kerry, M.C. (R.A.F., Ret.) (Dec. 9, 1938); H. G. Travers, D.S.C. (Jan. 3); L. J. Woollam (Jan 16); Lt. L. Daly, Capt. I. Larkins, Capt. C. F. Latimer, Capt. H. Glendenning (R.I.A.S.C., Ret.); Lt. F. A. Hobro, F. Larman, Sec. Lt. A. Tibbles (Sept. 1).

The following are granted commissions as Flight Lieutenants on the dates stated:—Lt. S. F. Ireland (Sept. 2); Lt. H. W. Alen-Buckley, Lt. K. W. Bransby (Sept. 6); D. C. H. Ferguson (Sept. 11); H. A. M. Weir (Sept. 13); Lt. F. W. Carryer, Sec. Lt. J. C. Farrer, Lt. L. H. Gamble, R. F. Williams (Sept 14); A. C. Gilmer, Lt. G. G. Harris, M.C., F. Hunter-Ward, Lt. J. D. McEwen, R. Melbourne, Lt. J. B. Palmer, F. J. S. Sampson (Sept. 15); Capt. G. M. Johnstone (Sept. 16); J. S. Charlton, Sec. Lt. W. S. Chrystal, Lt. H. F. Faulkner, Lt. N. A. Grinsted (I.A., Ret.), Sec. Lt. H. Kershaw, Lt. N. McCririck, Capt. R. C. Norris, Lt. G. Veevers-Carter (Sept. 18); Lt. F. R. Dymond, Capt. W. J. Matthews (Sept. 21); Capt. J. T. Chitty (Sept. 22); Capt. W. A. Dunn (Sept. 30).

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—R. F. J. Brooke (Sept. 6); T. H. E. Edwards (Sept. 7); G. U. Cuddon (Sept. 8); W. A. Fox (Sept. 12); E. W. Braendle, J. H. Bruce, W. C. Fahie, J. C. Martin (Sept. 29); N. Best (Oct. 2); P. N. Drew-Wilkinson (Oct. 6); M. P. Dalrymple, J. Newman (Oct. 12); H. A. Daniell, O.B.E., L. H. N. Irving (Oct. 17); L. F. Hutcheon, A.F.C., W. Kidd, P. C. Ricard (Oct. 18); V. Bowman-Burns, H. Law, G. E. Livesey (Oct. 19); S. R. Clark, J. L. Luntley, D. R. Smith-Bingham (Oct. 20); C. F. Lawson (Oct. 21); F. A. Downes, R. E. Le Lacheur, G. Mawer, T. H. Newsome, C. C. Powis (Oct. 23); F. L. M. Harris, C. M. Horsfell (Oct. 24); H. V. Stammers, D.F.C. (Oct. 25); A. E. Clarke, D.F.M., E. N. Clifton, D. G. Nairn, O.B.E., M. J. B. Stoker (Oct. 26); A. A. D. Sevastopulo, T. S. Singleton-Fleming, R. Tait (Oct. 27); J. W. Buchanan (Oct. 28).

Mr. R. Landau is granted a commission as Pilot Officer on probation with the honorary rank of Flying Officer (July 18). (Substituted for notification in *Gazette* of July 25).

The following are granted commissions as Pilot Officers on probation with the honorary rank of Flying Officer (Aug. 22):—R. G. Birkby, L. Evans, D. Muir, I. E. Roberts. (Substituted for notification in *Gazette* of Sept. 5.)

The following are granted commissions for the duration of hostilities as Pilot Officers on probation with the hon. rank of Flying Officer (Sept. 26):—J. E. Mills, G. W. Stevens. (Substituted for notification in *Gazette* of Oct. 3.)

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officers on the dates stated:—T. A. Francis (June 9); A. C. S. Buist, M.C., Sir R. Pigot, Bt. (Aug. 27); L. M. Glover, F. A. Lewis (Sept. 1).

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—E. R. Coulson (June 11), D. F. Massy (June 18) (Substituted for notification in *Gazette* of Oct. 3.)

The following Pilot Officers on probation resign their commissions on the dates stated:—M. C. Ellison (Sept. 7); H. C. Dumbell (Oct. 29).

F/O. S. W. Lewis relinquishes his commission on account of ill-health (Nov. 10). The notifications in the *Gazettes* of Sept. 26 and Oct. 27 concerning H. S. Evamy and R. C. Michael-on respectively, are cancelled.

Equipment Branch.

The following are granted commissions as Flight Lieutenants with effect from Sept. 1 and with seniority of the dates stated:—Flt. Lt. R. F. Wilson (R.A.F., Ret.) (Feb. 12, 1937); Flt. Lt. H. J. Brown (R.A.F., Ret.) (March 5, 1938); F/O. W. M. Moore (R.A.F., Ret.) (March 7, 1938); Capt. V. G. Harvey, M.C., D.C.M. (July 25, 1926); F/O. C. Reynolds (R.A.F., Ret.) (Oct. 6, 1938); Flt. Lt. W. J. Dew, M.B.E. (March 29); Flt. Lt. F. L. Kingham (R.A.F., Ret.) (June 13); Flt. Lt. J. Rodger, D.S.M. (R.A.F., Ret.) (June 26); F/O. P. H. Hunter (R.A.F., Ret.) (Aug. 1); F/O. F. Barnshaw (R.A.F., Ret.); F/O. A. H. Baker (R.A.F., Ret.), Mat. T. Calcott, M.B.E. (I.A., Ret.), Capt. S. G. Aylwin, Lt. J. Boston, Capt. G. F. Mulholland, Capt. E. G. Pease, Capt. (Quartermaster) W. H. Scott-Badcock; Maj. G. W. Hobbs (Sept. 1).

Accountant Branch.

The following are granted commissions as Flight Lieutenants (Sept. 1):—Maj. R. A. Downes, Capt. J. J. Hart, M.C.

Medical Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Group Captain.—C. P. Symonds, M.D., F.R.C.P. (Sept. 11). Wing Commander.—R. D. Gillespie, M.D., F.R.C.P. (Sept. 11). Flying Officers:—P. H. Lomax, M.R.C.S., L.R.C.P. (Oct. 12); R. G. D. Forward, M.B., B.Chir., M.R.C.S., L.R.C.P. D. H. Fowler, L.M.S.S.A., B. A. E. Harley, M.R.C.S., L.R.C.P., J. North, M.R.C.S., L.R.C.P., S. F. Robertson, M.D., S. Segal, M.R.C.S., L.R.C.P., F. N. Shuttleworth, M.B., Ch.B., D. Turner, M.B., Ch.B., M.R.C.S., L.R.C.P. (Oct. 24).

Dental Branch.

The following are granted commissions for the duration of hostilities as Flying Officers on the dates stated:—A. T. G. Garnett, L.D.S., M. E. Gascoine, L.D.S., C. V. Kark, L.D.S., D.M.D., K. W. Laws, B.D.S., D.M.D., W. R. Williams, L.D.S. (Oct. 16); J. O'C. Daniels, L.D.S. (Oct. 21); J. C. Fry, L.D.S.; S. C. Holms, H.D.D., L.D.S., M. R. C. Kemp, L.D.S., K. P. Liddelow, L.D.S., L. Malleson, L.D.S., T. D. H. Millar, L.D.S., W. R. J. Wood, L.D.S. (Oct. 23); W. J. Merker, L.D.S. (Oct. 25).

F/O. C. L. Hollick, L.D.S., relinquishes his commission on account of ill-health (Nov. 5).

Meteorological Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Group Captain.—F. Entwistle (Nov. 1). Flight Lieutenants.—D. Dewar, A. L. Mattens, P. J. Meade (Oct. 31), J. H. Brazell, T. H. Kirk (Nov. 7). Flying Officer.—A. C. Lloyd (Oct. 31). Pilot Officers.—D. F. Bowering, F. Davies (Oct. 31).

Chaplains Branch.

The following are granted commissions for the duration of hostilities with the relative rank of Squadron Leader on the dates stated:—The Rev. J. W. J. Cartner, B.A. (Sept. 8); the Rev. G. F. McL. Campbell, B.A. (Oct. 18); the Rev. J. B. Money (Oct. 27); the Rev. B. R. Bax (Oct. 30).

Errata.

In the *Gazette* of Oct. 17 for N. Wilkinson read N. Wilkinson, O.B.E.; in the *Gazette* of Oct. 27 for J. B. P. Angel read J. B. P. Angell; notification concerning list of appointments commencing with R. W. Beresford and ending with L. N. Henderson; for Pilot Officers read Pilot Officers on probation; in the *Gazette* of Oct. 31 notification concerning R. A. Wyatt, for Oct. 24 read Sept. 21.

Auxiliary Air Force

General Duties Branch.

No. 602 (CITY OF GLASGOW) SQUADRON.—P/O. N. Stone is promoted to the rank of Flying Officer (Aug. 20).

No. 605 (CITY OF EDINBURGH) SQUADRON.—The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—I. S. Ritchie (Aug. 15); C. D. Peel (Aug. 25).

No. 902 (COUNTY OF LONDON) SQUADRON.—F/O. H. S. Elton, M.C., is promoted to the rank of Flight Lieutenant (Sept. 18).

No. 910 (COUNTY OF ESSEX) SQUADRON.—Acting Pilot Officer on probation E. A. H. Smith is promoted to the rank of Flying Officer (Oct. 6).

No. 919 (WEST LANCASHIRE) SQUADRON.—F/O. F. G. Gaskin is promoted to the rank of Flight Lieutenant (Aug. 11).

No. 920 (WEST LANCASHIRE) SQUADRON.—Acting Pilot Officer on probation J. H. G. Pattinson is promoted to the rank of Flying Officer (Aug. 14).

No. 921 (WEST LANCASHIRE) SQUADRON.—Acting Pilot Officer on probation J. Rigby is promoted to the rank of Flying Officer (Aug. 11).

No. 923 (WEST LANCASHIRE) SQUADRON.—F/O. G. Sturgess is promoted to the rank of Flight Lieutenant (Sept. 7); Acting Pilot Officer on probation J. C. Burgess is confirmed in his appointment and graded as Pilot Officer, and is promoted to the rank of Flying Officer (Sept. 7). (Substituted for notification in *Gazette* of Oct. 10.)

No. 939 (WEST RIDING) SQUADRON.—Acting Pilot Officer on probation J. Hardy is confirmed in his appointment and graded as Pilot Officer (Oct. 17).

No. 940 (WEST RIDING) SQUADRON.—Acting Pilot Officer on probation G. A. Wright is confirmed in his appointment and graded as Pilot Officer (Oct. 17).

No. 942 (EAST RIDING) SQUADRON.—The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers (Oct. 17):—E. L. Fenton, E. P. Mayfield, C. B. North, N. W. Slack, G. Smith, G. V. Wright.

No. 943 (EAST RIDING) SQUADRON.—The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers (Oct. 17):—J. W. Chapman, T. J. Davies, F. W. Fargus, H. L. Jarman, S. L. Kilburn, J. Walton.

No. 944 (EAST RIDING) SQUADRON.—The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers (Oct. 17):—G. R. Andrews, W. L. Chapman, G. H. Dewick, W. Donnison, A. E. Frank, G. F. Sharpe.

Medical Branch.

No. 931 (HAMPSHIRE) SQUADRON.—J. Cann, B.A., M.A., M.B., B.Chir., M.R.C.S., L.R.C.P., is granted a commission as Flying Officer (Aug. 25).

Auxiliary Air Force Reserve of Officers

Accountant Branch.

No. 605 (COUNTY OF WARWICK) SQUADRON.—F/O. E. A. Titley relinquishes his commission (Aug. 1).

Women's Auxiliary Air Force

Mrs. Constance Marion Colbeck-Davis is appointed Company Asst. (Oct. 20).

Air Ministry, November 17.

The following are appointed Company Assistants on the dates stated:—Miss J. M. Barber, Miss P. D. Coward, Mrs. M. M. Fraser, Miss M. Garner, Miss J. F. Kelly, Miss J. M. Lyon, Miss A. M. Muir, Miss E. N. Scott-Elliot, Miss C. M. Wells (Nov. 8); Miss I. M. Dorrien Smith, Mrs. V. N. Owen (Nov. 10); Mrs. E. Beardsworth, Mrs. J. Birley, Miss G. M. Bradfield, Miss J. D. Howit, Miss E. A. G. Lywood, Miss P. M. Parker, Miss D. V. Pasley, Miss I. G. Taylor, Miss C. M. Wainwright, Miss M. D. Wilson, Miss M. H. H. Workman (Nov. 12).

Company Assistant Mrs. M. T. Bower resigns her appointment (Oct. 31).

Erratum.

In the *Gazette* of Oct. 27, under granting of short service commissions as A.P/Os., for G. M. Wiltshire read G. M. Wiltshear.

THE MOUNTAIN LABOURED — The yawning bomb-traps of this Boeing B-15 bomber of the U.S. Army Air Corps might have been expected to produce something more impressive than the hundred-pound bomb seen below it. The explanation is that it was at practice. Actually the machine can accommodate bombs of 2,000 lb. weight.

FOREIGN SERVICE NEWS

Light A.A. Guns in Spain

A SWISS writer who served for 2½ years with the Republican anti-aircraft artillery in Spain states that the 20 mm. Oerlikon A.A. gun gave trouble with its glycerine recoil brake due to the large differences in day and night temperatures. This prevented the gun being used at an elevation above 70 deg. The Oerlikon guns were completely worn out after firing 3,000 rounds.

Dutch Service Markings

THE new Dutch markings for military (army and navy) aircraft have now been officially defined. On upper and lower surfaces of the wing (in the case of biplanes, on the top surface of the upper wing and the lower surface of the lower wing) and on both sides of the fuselage there will be an equilateral triangle of orange, surrounded by a black border of about four inches. The vertical strip on the rudder is orange, also with a black edge of about four inches.

Projectile Penetration

SOME interesting experiments have been conducted in France on the penetration of projectiles.

The projectile used was of 13.2 mm. calibre with a brass coating and a steel core. Both the velocity and the hardness could be varied. Penetration into an unlimited quantity of dry sand was practically constant (25 cm.) for any muzzle velocity beyond 400 m./sec. At 800 m./sec., however, the bullet would pass readily through a wall of sand double this thickness. Firing into a lead block yielded similar results.

It was confirmed that the hardness of the bullet core governed the penetration of steel, the softer bullet spreading on impact and being reflected. In the case of aluminium plates, however, the hardness of the bullet had but little effect on penetration. It was noted that at 800 m./sec. the penetration of a hard-core bullet was of the order of 5 cm. for mild steel and double this for cast aluminium.

Apparently each material has a limit of maximum penetration which cannot be exceeded, however great the impact velocity, except by increasing the mass of the bullet.

Without Comment

OUR American contemporary, *U.S. Air Services*, states that Mr. Bernard McFadden offered a thousand dollars some time ago for what is described as "a nifty song" for official use in the U.S. Army Air Corps. The name of the song is *The Army Air Corps* and the words of the first verse are:—

"Oft we go into the wild blue yonder,
Climbing high into the sun;
Here they come zooming to meet our thunder,
At 'em boys, give'r the gun!
Down we dive spouting our flame from under
Off with one helluva roar!
We live in fame
Or go down in flame
BOY! nothing'll stop the Army Air Corps!

NAVAL NOVELTY: The Curtiss XSO-3CI with a twelve-cylinder inverted-vee Ranger engine is a new American type for operation from warships. Its float undercarriage is among the cleanest yet designed. Visibility is obviously very good indeed and the machine should be quite fast for one of its type.

HERE and THERE

The Canada Training Scheme

REPORTS from Ottawa state that complete agreement has been reached by the Canadian, Home, and other Dominion Governments on the details of the plan for giving intermediate and advanced training in Canada to pilots and observers from the parts of the Empire concerned. The details will soon be made public, it is understood. At first it was alleged that Canada would construct a hundred new aerodromes, but a later report says that at first thirty airports belonging to Trans-Canada Airways and fifteen municipal airports will be used. Also that Canada will pay the initial cost, but will afterwards receive contributions from the other three Governments. The Home Government will probably contribute 1,000 training aircraft. It can be added that the pilots will be trained on the lines and up to the standard of the Central Flying School in this country.

An Appreciation

MY friend, Bill Skinner, died from cerebral hæmorrhage on Wednesday, the 15th November, 1939. He was, as most flying people know, Chief Test Pilot to Phillips & Powis Aircraft, Limited. He joined us as an Instructor in our R.T.S. School, when it started in 1935, and transferred over to the testing job two years ago. He took a fierce interest and a constant delight in his work; I have never seen his desk except occupied by a technical book or report left marked and open—usually while he had been called away on his routine flight tests.

He really knew his job and until his death he was entering more and more into the life of the firm.

In addition to the ordinary everyday test work he contributed a great deal of knowledge toward the spinning of low-wing monoplanes. He was, I believe, the first man in England to recover from an uncontrollable spin by means of a tail parachute; certainly nobody knew for certain that it would work and we *did* know the spin became uncontrollable.

His work made it possible to develop monoplanes which are absolutely safe in the spin. He has probably tested more purely experimental wings, gadgets and aeroplanes than any other pilot over a similar period, and his reports were a model.

When he had a dangerous job he did everything that common sense and knowledge could do to make it safe; if it was still dangerous he still did it.

We miss him very much and extend our deepest sympathy to his widow and two children. F. G. MILES.

(*A portrait of Mr. Skinner appears on p.* 417)

—but occasionally the parachutist misjudges his descent and has to do a squirrel act.

FIGHTING FOREST FIRES: American air patrols sometimes drop men close to the scene of the fire—

"Flight" Postcards

WE are pleased to announce the addition of a further nine aircraft types of our series of photographic postcards of machines of the R.F.C., R.N.A.S. and R.A.F. Almost any type which has entered the Service in some quantity is available, from Maurice Farmans and R.E.8s to the Vickers-Supermarine Spitfire. The new types now added are:—Bristol Beaufort; Bristol Blenheim (Long Nosed); Lockheed Hudson; North American Harvard; Miles Master; Saro Lerwick; Boulton Paul Defiant; Armstrong Whitworth Merlin-Whitley and Blackburn Roc.

Prices are:—Single cards, 4d. each; one dozen or more, 3d. each, post free.

FLIGHT

IDENTIFICATION CHART OF GERMAN AIRCRAFT

THE most useful chart of enemy aircraft yet devised is now available from the offices of *Flight*.

Measuring 22½ in. by 14½ in. the wall card embodies 72 drawings showing head-on, broadside, overhead and underside views of the principal types.

Price one shilling, postage sixpence extra.

THE INDUSTRY

Watchmakers and Engineers

AS a criterion of experience in the production of accurate and intricate small work, Rotherhams, of Coventry, in a new folder, draw attention to the fact that they were pioneers of the English watchmaking industry nearly 200 years ago.

Clock- and watchmaking still occupies a large proportion of their business, but the output of A.G.S. parts for supply to the aircraft industry is now thought of in terms of millions. Precision small parts, specialised instruments, multi-way cocks, and electric oil indicators are but the smallest indication of the range of work handled by this old-established, up-to-date firm.

Machine Tool Agency

BROADWAY ENGINEERING CO., LTD., Carlisle Road, London, N.W.9, have been appointed sole European agents for the W. B. Knight Machinery Co., St. Louis, Missouri, who are manufacturers of high-speed vertical milling machines.

Models Nos. 20, 30 and 40 will be introduced on this side of the Atlantic. They are high-speed machines which can, if required, be equipped with precision-measuring instruments for jig-boring. Attachments for circular milling, index milling and shaping are available, and all models are provided with tilting and swivelling tables.

Foresight

GENERAL AIRCRAFT CO., LTD., have sent us their latest booklet dealing with the Cygnet monoplane, and in their covering letter the following passage occurs: "We send it to you not only because we feel it is one of the best examples of this type of literature, but also because it symbolises the policy of this company—to keep overseas trade active in spite of present difficulties. It has been said that, in winning the war, England must not lose her overseas markets as she did in 1914-18."

This quotation sums up everything nicely. It is a good booklet, with a good policy about a good aeroplane. There is a complete specification, full performance figures, a general arrangement drawing, a summary of weights and loadings, and some excellent illustrations. Prospective buyers should apply for a copy to General Aircraft Co., Ltd., The London Air Park, Feltham, Middlesex, England.

Hours of Business

FLIGHT is requested to inform the aircraft industry that until further notice the head offices of Brown Bros. (Aircraft), Ltd., at Great Eastern Street, E.C.2, will be open for business from 8.30 a.m. to 5 p.m. from Mondays to Fridays and 8.30 a.m. to 12.30 p.m. on Saturdays.

Birmabright Brochure

IN an attractive brochure just issued, Birmabright explain, with text supplemented by many attractive illustrations, a few of the many applications of this "metal of the future which must be light, strong, resistant to corrosion and easy to fabricate," as they term it.

Aircraft construction, of course, comes in for a fair share, as one would expect when dealing with light alloys, but perhaps the chapter most useful to the industry is that which deals with the mechanical properties. Here the various grades are discussed regarding qualities such as casting, working, machining, welding (oxy-acetylene and both spot and arc electric welding), soldering and brazing, polishing, anodic treatment and application of paints and lacquers.

Copies can be had from Birmabright, Ltd., Woodgate, Quinton, Birmingham, 32.

NEW COMPANIES

THERMO-PLASTIC PRODUCTS, LTD. Private company. Registered November 13. Capital £1,000 in 1,000 ordinary shares of £1 each. Objects: Aeronautical experts, consultants, manufacturers, repairers of and dealers in all forms of aircraft, etc. Subscribers (one share): W. R. Carter, F.Inst.P.S., 7/8, Turnstile, W.C.1; L. G. Fairclough, 1, Bristol House, Southampton Row, W.C.1; Abraham Reingard, 53, Mead Way, Dunstable, to be first director (10 shares). Registered office: 76, Golden Lane, E.C.1.

B. & T. AIRCRAFT ENGINEERING, LTD. Private company. Registered November 11, 1939. Capital £5,000 in 5,000 ordinary shares of £1 each. Objects: Engineers, founders, smiths, machinists, manufacturers and assemblers of aircraft components, etc. Directors: John Boneham, Elm House, Nottingham Road, Mansfield; Ralph Cooper, High Oak Farm, Mansfield. Solicitors: Marchant & Co., Halford Chambers, Mansfield.

Vokes' Good Year

AT the third annual general meeting, held this week, the chairman, Sir Ian Stewart Richardson, Bart., was able to report to the shareholders an exceptional year. Sales for the period under review exceeded those for the previous year by 250 per cent., necessitating the erection of a new plant in Hampshire to cope with the demand, which promised to be even greater in future. In fact, the orders actually in hand make a new high mark in the history of the company.

The directors have entered into a new agreement with the managing director, Mr. Cecil Gordon Vokes, A.M.I.Mech.E., A.M.I.Ae.E., M.S.A.E., retaining his services for a further three years after the expiry of the present agreement, at the same time increasing his remuneration from £750 to £1,500. It is interesting to note that the prosperity is not due solely to Government orders, the export department being busily engaged in maintaining and expanding overseas markets. To help to this end the company has decided to incorporate a subsidiary company in Australia, and an arrangement has been entered into for the sale of the firm's products in France. A dividend of 12½ per cent. was declared.

PUBLICATIONS RECEIVED.

How They Fly, by James Gardner; 3s. 6d. Country Life, Ltd., 20, Tavistock Street, London, W.C.2.

20 Ans de Trafic Aerien Suisse. Swiss Air Traffic Co., Ltd., Zurich-Flugplatz, Switzerland.

Aero-Engines ("D" Licence), by A. N. Barrett; 3s. 6d., Sir Isaac Pitman and Sons, Ltd., Parker Street, Kingsway, London, W.C.2

AERONAUTICAL PATENT SPECIFICATIONS

(*Published October 18, 1939.*)

1937.

34663. VICKERS-ARMSTRONGS, LTD., and WATSON, J. P. Electric follow-up control systems (513,053).

35916. LAVAUD, R. S. DE. Propellers having an automatically variable pitch (513,104).

36098. GENERAL ELECTRIC CO., LTD., and PETERS, W. H. Tuning devices for wireless receivers (513,252).

1938.

3871. DOWNING, A. E. Aircraft (513,156).

6695. DORNIER-WERKE *Ges.*, and DORNIER, C. Airscrews (513,258).

6901. EXPANDED RUBBER CO., LTD., and GOODHART, G. C. Pneumatic tyres for land and other vehicles (513,261).

8335. PRATT, J. H., MANLEY, G. E., and GIRLINGS, A. H. G. Brake mechanisms (513,115).

9830. VOIGT, C. A. Mounting of aircraft and like motors (513,085).

10009. NEWSTEAD, H. W. Landing-lights for use on emergency landing-grounds for aircraft (513,223).

10094. STANDARD TELEPHONES & CABLES, LTD., and HODGSON, K. G. Carrier-wave signalling systems (513,229).

10193. WEBSTER, W. J. Rear-light indicator or detector for vehicles (513,177).

10597. SIEMENS APPARATE UND MASCHINEN GES. Gyroscopes (513,290).

13959. BENDIX AVIATION CORPORATION. Indicating instruments (513,182).

13961. BENDIX AVIATION CORPORATION. Temperature-compensating means in indicating or measuring instruments (513,183).

14187. BENDIX AVIATION CORPORATION. Indicating instruments (513,184).

16005. CARTER CARBURETTOR CORPORATION. Means for the control of ignition timing of internal-combustion engines (513,142).

21388. FLEISHER, W. L. Method of and apparatus for cooling or conditioning air (513,145).

1939.

980. GLEASON WORKS. Manufacture of gears (513,102).

10306. GLEASON WORKS. Manufacture of gears (513,239).

7227. BELAIEFF, J. F., DELANEY, C. T., and GALLAY, LTD. Radiators for internal-combustion engines (513,199).

11049. FULTON, C. HERNU, P., and WHITE, A. E.: Rotary engines, pumps or compressors (513,450).

11234. ASSOCIATED ELECTRIC LABORATORIES, INC.: Automatic switches for use in telephone or like systems (513,507).

11279. ADIE, K. S.: Electric light fittings (513,546).

11294. SMITH, LTD., J., and HARVEY, C. D.: Plug cocks or valves (513,547).

11302. LUCAS, LTD., J., and NEILL, R. L.: Vehicle lamps (513,548).

11310. FERNSEH AKT.-GES: Television and like apparatus (513,549).

11342 SIEMENS BROS. & CO., LTD., and CHRISTIAN, D. A.: Telephone and like signalling systems (513,552).

11389. TRIST & CO., LTD., R., ROBBINS, R. A., and WAKLEY, T. L.: Aircraft pipe couplings (513,555).

11795. AUTO UNION AKT.-GES.: Combined accelerator pedal and gear-change device (513,557).

16446. GOHIN, J.: Gas producers for feeding fuel to internal-combustion engines (513,347).

18961. GOODMAN, J. H.: Internal-combustion engines of the compression-ignition type (513,381).

20501. WERTH, K.: Sparking plug (513,382).

24812. ATWOOD, S. B., and ATWOOD, J. T.: Automobile door hinges (513,461).

37589. ELLIOTT, N. C., and PRINGLE, G.: Chairs or the like articles of furniture (513,387).

741. MANSELL, W. C. G.: Charge-mixing devices for internal combustion engines (513,356).

1124. ZAVODY RINGHOFFER-TATRA ACKCIOVA SPOLECNOST: Arrangement of the outlet for cooling air in streamlined motor vehicles (513,357).

3839. HEYWOOD, C. F.: Device for facilitating the starting of an internal-combustion engine by means of compressed air (513,392).

10686. BRITISH THOMSON-HOUSTON CO., LTD.: Valves (513,401).

11325 AKT.-GES. BROWN, BOVERI, & CIE.: Liquid-sealed slip-ring stuffing boxes for rotating shafts (513,403).

11508. BABCOCK & WILCOX, LTD. (BABCOCK & WILCOX CO.): Pulverised fuel burning apparatus (513,404).

20590. AUTOMATIC TELEPHONE & ELECTRIC CO., LTD., *and* TERRONI, T. B. D.: Electrical signalling systems (513,409).